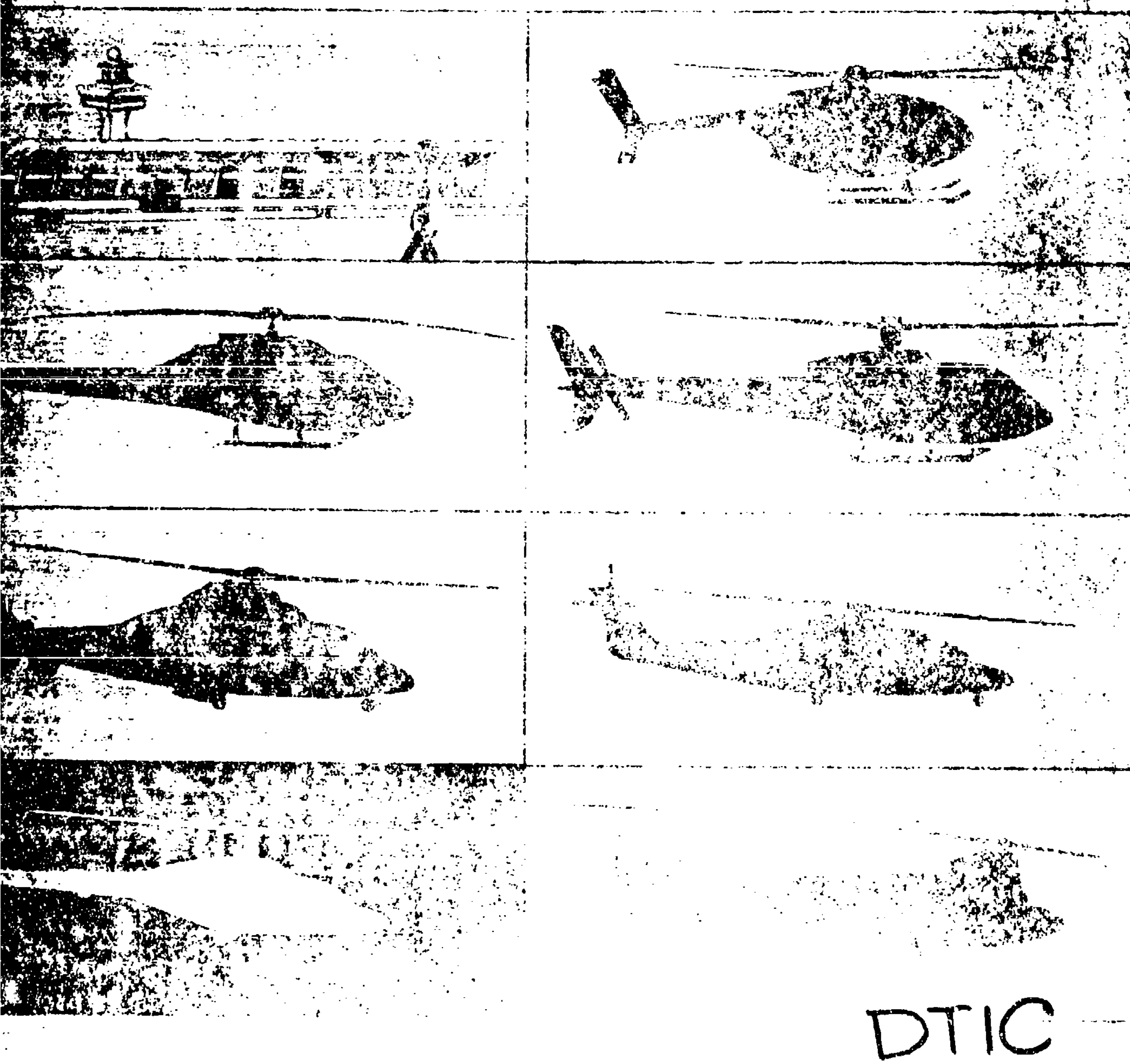
A-EE-84-1

AD A 139906

Noise Measurement Flight Test: Data/Analyses Bell 222 Twin Jet Helicopter

Environmental and Energy
on, D.C. 20591



nt is available to ...
ic through the ...
al Information ...
eld, Virginia 2216...

DTIC

APR 09 1984

E

ABOUT THE COVER

[illegible] (and subsequent reports in this series) is [illegible] of the seven helicopters tested during the summer [illegible] International Airport. The highlighted outline is that [illegible] 222, the subject of this report. The helicopters shown on the [illegible] include (clockwise from the upper right) the Hughes 500-D, the [illegible] TwinStar, the Sikorsky S-76, the Boeing Vertol BV-234/CH-47D, [illegible] 222, the Aerospatiale Dauphin, and the Aero[illegible] AStar.

NOTICE

The United States Government does not [illegible] of manufacturers. [illegible] used as necessary in documenting the sub[illegible]

Technical Report Documentation Page

1. Report No. FAA-EE-84-1

2. Government Accession No. AD-A137706

3. Recipient's Catalog No.

4. Title and Subtitle
Noise Measurement Flight Test for the Bell 222 Twin Jet Helicopter: Data and Analyses

5. Report Date February 1984

6. Performing Organization Code

7. Author(s) J. Steven Newman, Edward J. Rickley(1) Tyrone L. Bland, Sharon A. Daboin

8. Performing Organization Report No.

9. Performing Organization Name and Address
Federal Aviation Administration, Office of Environment and Energy, Noise Abatement Division, Noise Technology Branch, (AEE-120), 800 Independence Ave., SW
Washington, DC 20591

10. Work Unit No. (TRAIS)

11. Contract or Grant No.

13. Type of Report and Period Covered

12. Sponsoring Agency Name and Address
Federal Aviation Administration, Office of Environment and Energy, Noise Abatement Division, Noise Technology Branch, (AEE-120), 800 Independence Ave., SW
Washington, DC 20591

14. Sponsoring Agency Code

15. Supplementary Notes
(1) U.S. Department of Transportation, Transportation Systems Center, Kendall Square, Cambridge, Mass 02142

16. Abstract

This report documents the results of a Federal Aviation Administration (FAA) noise measurement flight test program with the Bell 222 twin-jet helicopter. The report contains documentary sections describing the acoustical characteristics of the subject helicopter and provides analyses and discussions addressing topics ranging from acoustical propagation to environmental impact of helicopter noise.

This report is the first in a series of seven documenting the FAA helicopter noise measurement program conducted at Dulles International Airport during the summer of 1983. The Bell 222 test program involved the acquisition of detailed acoustical, position and meteorological data.

This test program was designed to address a series of objectives including: 1) evaluation of "Fly Neighborly" (minimum noise) operating procedures for helicopters, 2) acquisition of acoustical data for use in heliport environmental impact, 3) documentation of directivity characteristics for static operation of helicopters, 4) establishment of ground-to-ground and air-to-ground acoustical propagation relationships for helicopters, 5) determination of noise event duration influences on energy dose acoustical metrics, 6) examination of the differences between noise measured by a surface mounted microphone and a microphone mounted at a height of four feet (1.2 meters), and 7) documentation of noise levels acquired using international helicopter noise certification test procedures.

17. Key Words
helicopter, noise, Bell 222, heliport environmental impact, directivity, noise certification standards

18. Distribution Statement
This document is available to the public through the National Technical Information Service, Springfield, VA 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	224	

Form DOT F 1700.7 (8-72) **Reproduction of completed page authorized**

Acknowledgments

The authors wish to thank the following individuals and organizations who contributed to the success of the measurement program and/or the production of this report.

1. The Bell Helicopter Textron, for providing the test helicopter, the flight crew, and the test coordination assistance of Mr. Charlie Cox.

2. The Dulles Air Traffic Control Tower - Mr. Art Harrison, Chief

3. The National Air and Space Administration (NASA), Rotorcraft Office, and Mr. John Ward for their support of data reduction activities.

4. Ms. Kristy Beattie of ORI, Inc. for report coordination and editorial assistance.

5. Ms. Loretta Harrison for her typing and report production assistance.

TABLE OF CONTENTS

PAGE

LIST OF TABLES

LIST OF FIGURES

GLOSSARY

AGL	-	Above ground level
AIR	-	Aerospace Information Report
AL	-	A-Weighted sound level, expressed in decibels (See L_A)
AL_M	-	Maximum A-weighted sound level, expressed in decibels (see L_{AM})
AL_{AM}	-	As measured maximum A-weighted Level
ALT	-	Aircraft altitude above the microphone location
APP	-	Approach operational mode
CLC	-	Centerline Center
CPA	-	Closest point of approach
d	-	Distance
dB	-	Decibel
dBA	-	A-Weighted sound level expressed in units of decibels (see A_L)
df	-	Degree of freedom
Δ	-	Delta, or change in value
$\Delta 1$	-	Correction term obtained by correcting SPL values for atmospheric absorption and flight track deviations per FAR 36, Amendment 9, Appendix A, Section A36.11, Paragraph d
$\Delta 2$	-	Correction term accounting for changes in event duration with deviations from the reference flight path
dB	-	Decibel
DUR(A)	-	"10 dB-Down" duration of L_A time history

EPNL	-	Effective perceived noise level (symbol is LEPN)
EV	-	Event, test run number
FAA	-	Federal Aviation Administration
FAR	-	Federal Aviation Regulation
FAR-36	-	Federal Aviation Regulation, Part 36
GLR	-	Graphic level recorder
HIGE	-	Hover-in-ground effect
HOGE	-	Hover-out-of-ground effect
IAS	-	Indicated airspeed
ICAO	-	International Civil Aviation Organization
IRIG-B	-	Inter-Range Instrumentation Group B (established technical time code standard)
K(A)	-	Propagation constant describing the change in dBA with distance
K(DUR)	-	The constant used to correct SEL for distance and velocity duration effects in $\Delta 2$
KIAS	-	Knots Indicated Air Speed
K(S)	-	Propagation constant describing the change in SEL with distance
Kts	-	Knots
Leq	-	Symbol for equivalent sound level
LFO	-	Level Flyover operational mode
N	-	Sample Size
NWS	-	National Weather Service
$OASPL_M$	-	Maximum overall sound pressure level in decibels
PISLM	-	Precision integrating sound level meter

PNL_M	-	Maximum perceived noise level
$PNLT_M$	-	Maximum tone corrected perceived noise level
POP	-	Photo overhead positioning system
Q	-	Time history "shape factor"
RH	-	Relative Humidity in percent
RPM	-	Revolutions per minute
SAE	-	Society of Automotive Engineers
SEL	-	Sound exposure level expressed in decibels. The integration of the AL time history, normalized to 1 second (symbol is L_{AE})
SEL_{AM}	-	As measured sound exposure level
$SEL-AL_M$	-	Duration correction factor
SHP	-	Shaft horse power
SLR	-	Single lens reflex (35 mm camera)
SPL	-	Sound pressure level
T	-	Ten dB down duration time
TC	-	Tone correction calcualted at $PNLT_M$
T/O	-	Takeoff
TSC	-	Department of Transportation, Transportation Systems Center
V	-	Velocity
VASI	-	Visual Approach Slope Indicator
V_H	-	Maximum speed in level flight with maximum continuous power
V_{NE}	-	Never-exceed speed
Vy	-	Velocity for best rate of climb

1.0 Introduction - This report documents the results of a Federal Aviation Administration (FAA) noise measurement/flight test program involving the Bell 222 twin-jet helicopter. The report contains documentary sections describing the acoustical characteristics of the subject helicopter and provides analyses and discussions addressing topics ranging from acoustical propagation to environmental impact of helicopter noise.

This report is the first in a series of seven documenting the FAA helicopter noise measurement program conducted at Dulles International Airport during the summer of 1983.

The test program was conducted by the FAA in connection with Bell Helicopter Textron and a number of supporting Federal agencies. The rigorously controlled tests involved the acquisition of detailed acoustical, position and meteorological data.

This test program was designed to address a series of objectives including: 1) evaluation of "Fly Neighborly" (minimum noise) operating procedures for helicopters, 2) acquisition of acoustical data for use in heliport environmental impact analyses, 3) documentation of directivity characteristics for static operation of helicopters, (4) establishment of ground-to-ground and air-to-ground acoustical propagation relationships for helicopters, 5) determination of noise event duration influences on energy dose acoustical metrics, 6) examination of the differences between noise measured by a surface mounted microphone and a microphone mounted at a height of four feet (1.2 meters), and 7) documentation of noise levels acquired using international helicopter noise certification test procedures.

The appendices to this document provide a reference set of acoustical data for the Bell 222 helicopter operating in a variety of typical flight regimes. The first seven chapters contain the introduction and description of the helicopter, test procedures and test equipment. Chapter 8 describes analyses of flight trajectories and meteorological data and is documentary in nature. Chapter 9 delves into the areas of acoustical propagation, helicopter directivity for static operations, and variability in measured acoustical data over various propagation surfaces. The analyses of Chapter 9 in some cases succeed in establishing relationships characterizing the acoustic nature of the subject helicopter, while in other instances the results are too variant and anomalous to draw any firm conclusions. In any event, all of the analyses provide useful insight to people working in the field of helicopter environmental acoustics, either in providing a tool or by identifying areas which need the illumination of further research efforts.

TEST HELICOPTER DESCRIPTION

2.0 Test Helicopter Description - The Bell 222 is a twin turbine-powered transport helicopter capable of carrying 8 passengers and a crew of two. The helicopter is manufactured by Bell Helicopter Textron of Ft. Worth, Texas, and was certificated by the FAA in August 1979. It was the first commercial light twin-engined helicopter to be built in the United States of America. Standard features of the aircraft include a 135 cubic foot ($3.82m^3$) passenger cabin which provides space for people over 6 feet tall, a 500 lb baggage compartment, provisions for an environmental control system and soundproofing.

Besides the standard configuration (the Bell 222A), the helicopter is available in two others: the 222 Executive, which features luxury accommodations, and the 222 Offshore, a craft equipped with a flotation system and auxiliary fuel tanks for operations over water.

Selected operational characteristics, obtained from the helicopter manufacturer, are presented in Table 2.1.

Table 2.2 presents a summary of the operational reference parameters determined using the procedures specified in the International Civil Aviation Organization (ICAO) noise certification testing requirements. Presented along with the operational parameters are the altitudes that one would expect the helicopter to attain (referred to the ICAO reference test sites). This information is provided so that the reader may implement an ICAO type data correction using the "As Measured" data contained in this report. This report does not undertake such a correction, leaving it as the topic of a subsequent report.

TABLE 2.1

HELICOPTER CHARACTERISTICS

HELICOPTER MANUFACTURER	: BELL HELICOPTER TEXTRON
HELICOPTER MODEL	: BELL 222
HELICOPTER TYPE	: SINGLE ROTOR
TEST HELICOPTER N-NUMBER	: N2057B
MAXIMUM GROSS TAKEOFF WEIGHT	: 7850 lbs 93560 kg)
NUMBER AND TYPE OF ENGINE(S)	: 2 LYCOMING LTS 101-650C-3
SHAFT HORSE POWER (PER ENGINE)	: 575 SHP (Takeoff power installed sea level standard day)
MAXIMUM CONTINUOUS POWER	: 1110 SHP (sea level standard day; 555 SHP per engine)
SPECIFIC FUEL CONSUMPTION AT MAXIMUM POWER (LB/HR/HP)	: .514 (lb/hr/hp)
NEVER EXCEED SPEED (V_{NE})	: 141 KIAS
MAX SPEED IN LEVEL FLIGHT WITH MAX CONTINUOUS POWER (V_H)	: 141 KIAS
SPEED FOR BEST RATE OF CLIMB (Vy)	: 65 KIAS
BEST RATE OF CLIMB	: 1600 fpm

MAIN AND TAIL ROTOR SPECIFICATIONS

	MAIN	TAIL
ROTOR SPEED (100%)	: 348 rpm	1881 rpm
DIAMETER	: 477.0 in	78.0 in
CHORD	: 28.6 in	10.0 in
NUMBER OF BLADES	: 2	2
PERIPHERAL VELOCITY	: 724 fps	641 fps
BLADE LOAD	: 83 lb/ft^2	-
FUNDAMENTAL BLADE PASSAGE FREQUENCY	: 12 Hz	63 Hz
ROTATIONAL TIP MACH NUMBER (77°F)	: .6375	.5636

TABLE 2.2

ICAO REFERENCE PARAMETERS

	TAKEOFF	APPROACH	LEVEL FLYOVER
AIRSPEED (KTS)	: 65	65	127
RATE OF CLIMB/DESCENT (fpm)	: 1600	688	NA
CLIMB/DESCENT ANGLE (DEGREES)	: 14.1	6.0	NA
ALTITUDE/CPA (FEET)			
SITE 5	:257/249	329/327	492
SITE 1	:412/400	394/392	492
SITE 4	:536/520	446/443	492
SLANT RANGE (FEET) TO			
SITE 2	: 642	630	696
SITE 3	: 642	630	696

TEST SYNOPSIS

3.0 Test Synopsis - Below is a listing of pertinent details pertaining to the execution of the helicopter tests.

1. Test Sponsor, Program Management, and Data Analysis: Federal Aviation Administration, Office of Environment and Energy, Noise Abatement Division, Noise Technology Branch (AEE-120).

2. Test Helicopter: Bell-222, provided by Bell Helicopter Textron.

3. Test Dates: Tuesday, June 14, Wednesday, June 15, and Thursday, June 16, 1983.

4. Test Location: Dulles International Airport, Runway 30 over-run area.

5. Noise Data Measurement (recording), processing and analysis: Department of Transportation (DOT), Transportation Systems Center (TSC), Noise Measurement and Assessment Facility.

6. Noise Data Measurement (direct-read), processing and analaysis: FAA, Noise Technology Branch, (AEE-120).

7. Cockpit instrument photo documentation; photo-altitude determination system; documentary photographs: Department of Transportation, Photographic Services Laboratory.

8. Meteorological Data (fifteen minute observations): National Weather Service Office, Dulles International Airport.

9. Meteorological Data (radiosonde/rawinsonde weather balloon launches): National Weather Service Upper Air Station, Sterling Park, Virginia.

10. Meteorological Data (on site observations): DOT-TSC.

11. Flight Path Guidance (portable visual approach slope indicator (VASI) and theodolite/verbal course corrections): FAA Technical Center, ACT-310.

12. Air Traffic Control: Dulles International Airport Air Traffic Control Tower.

13. Test site preparation; surveying, clearing underbrush, connecting electrical power, providing markers, painting signs, and building the radar pad: Dulles International Airport Grounds and Maintenance, and Airways Facilities personnel.

Figure 3.1 is a photo collage of flight test and measurement personnel performing their tasks.

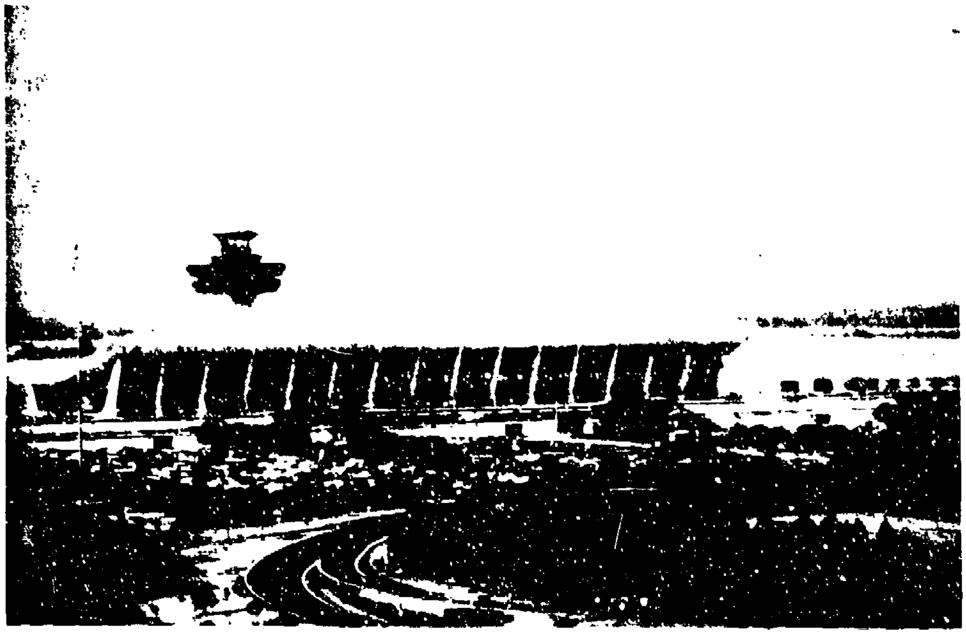
3.1 Measurement Facility - The noise measurement testing area was located adjacent to the approach end of Runway 12 at Dulles International Airport. (The approach end of Runway 12 is synonymous with Runway 30 over-run area.) The low ambient noise level, the availability of emergency equipment, and the security of the area all made this location desirable. Figure 3.2 provides a picture of the Dulles terminal and of the test area.

The test area adjacent to the runway was nominally flat with a ground cover of short, clipped grass, approximately 1800 feet by 2200 feet, and bordered on north, south, and west by woods. There was minimum interference from the commercial and general aviation activity at the airport since Runway 12/30 was closed to normal traffic during the tests. The runways used for normal traffic, 1L and 1R, were approximately 2 and 3 miles east, respectively, of the test site.

Figure 3.1

Flight Test and Noise Measurement Personnel In Action

Figure 3.2



The Terminal and Air Traffic Control Tower
at Dulles International Airport

Approach to Runway 12 at Dulles Noise
Measurement Site for 1983 Hel copter Tests

The flight track centerline was located parallel to Runway 12/30 between the runway and the taxiway. The helicopter hover point for the static operation was located on the southwest corner of the approach end of Runway 12. Eight noise measurement sites were established in the grassy area adjacent to the Runway 12 approach ground track.

3.2 Microphone Locations - There were eight separate microphone sites located within the testing area, making up two measurement arrays. One array was used for the flight operations, the other for the static operations. A schematic of the test area is shown in Figure 3.3.

A. Flight Operations - The microphone array for flight operations consisted of two sideline sites, numbered 2 and 3 in Figure 3.3, and three centerline sites, numbered 5, 1, and 4, located directly below the flight path of the helicopter. Since site number 3, the north sideline site, was located in a lightly wooded area, it was necessary to offset it 46 feet to the west to provide sufficient clearance from surrounding trees and bushes.

B. Static Operations - The microphone array for static operations consisted of sites 7H, 5H, 1H, 2, and 4H. These sites were situated around the helicopter hover point which was located on the southwest corner of the approach end of Runway 12. These site locations allowed for both hard and soft ground-to-ground propagation paths.

3.3 Flight Path Markers and Guidance System Locations - Visual cues in the form of squares of plywood painted bright yellow with a black "X" in the center were provided to define the takeoff rotation point. This point was located 1640 feet (500 m) from centerline center (CLC) microphone

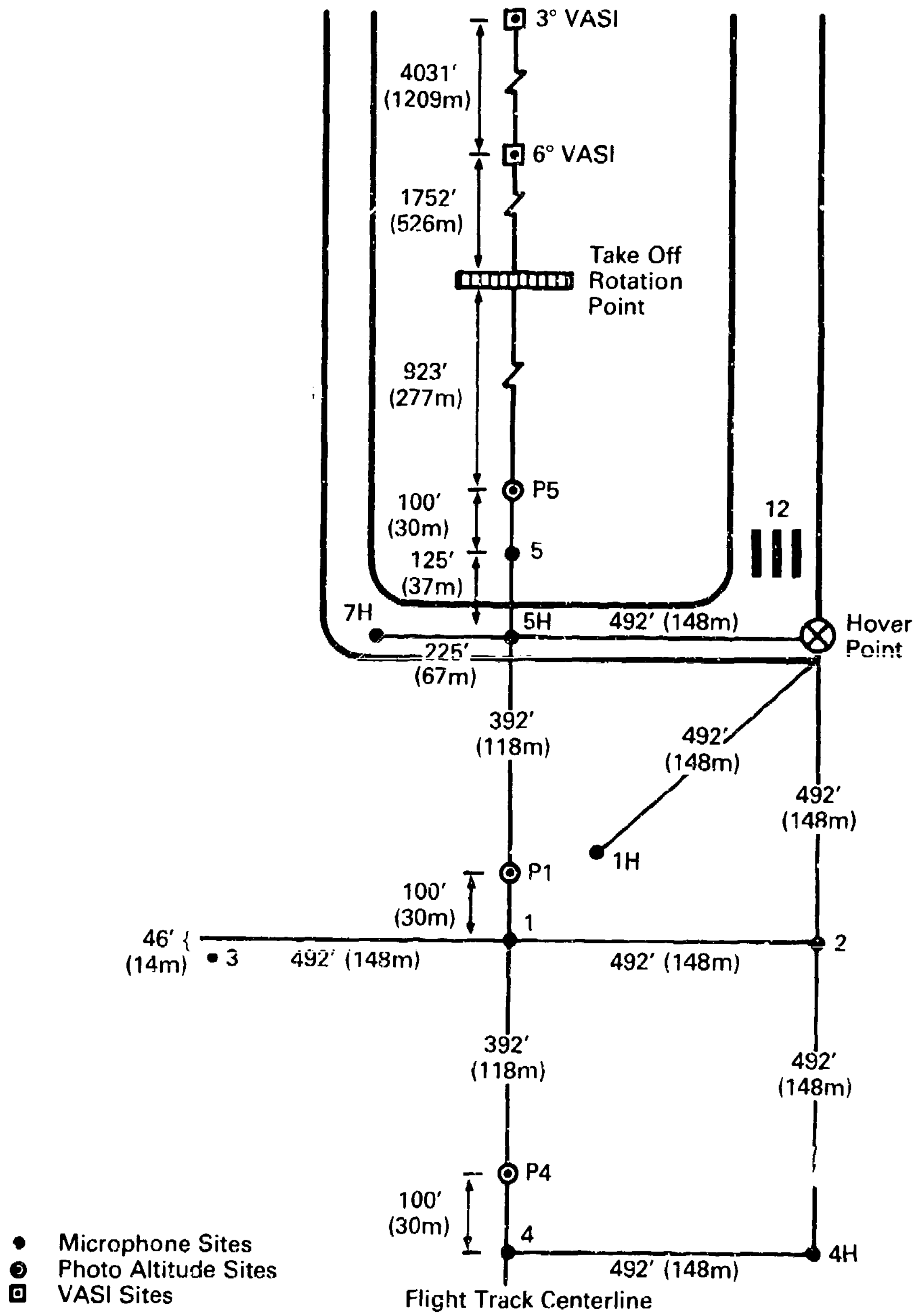
location. Four portable, battery-powered spotlights were deployed at various locations to assist pilots in maintaining the array centerline. To provide visual guidance during the approach portion of the test, a standard visual approach slope indicator (VASI) system was used. In addition to the visual guidance, the VASI crew also provided verbal guidance with the aid of a transit. Both methods assisted the helicopter pilot in adhering to the microphone array centerline and in maintaining the proper approach path. The locations of the VASI from CLC are shown in the following table.

Approach Angle (degrees)	Distance from CLC (feet)
12	1830
9	2456
6	3392
3	7423

Each of these locations provided a glidepath which crossed over the centerline center microphone location at an altitude of 394 feet.

Figure 3.3

Noise Measurement and Photo Site Schematic



NOTES: Broken Line Indicates not to Scale.
Metric Measurements to
Nearest Meter.

TEST PLANNING AND BACKGROUND

4.0 Test Planning/Background Activities - This section provides a brief discussion of important administrative and test planning activities.

4.1 Test Program Advance Briefings and Coordination - A pre-test briefing was conducted approximately one month prior to the test. The meeting was attended by all pilots participating in the test, along with FAA program managers, manufacturer test coordinators, and other key test participants from the Dulles Airport community. During this meeting, the airspace safety and communications protocol were rigorously defined and at the same time test participants were able to iron out logistical and procedural details. On the morning of the test, a final brief meeting was convened on the flight line to review safety rules and coordinate last-minute changes in the test schedule.

4.2 Communications Network - During the helicopter noise measurement test, an elaborate communications network was utilized to manage the various systems and crews. This network was headed by a central group which coordinated the testing using three two-way radio systems, designated as Radios 1-3.

Radio 1 was a walkie talkie system operating on 169.275 MHz, providing communications between the VASI, National Weather Service, FAA Acoustic Measurement crew, the TSC acoustic team coordinator, and the noise test coordinating team.

Radio 2 was a second walkie talkie system operating on 170.40 MHz, providing communications between the TSC acoustic team coordinator and the TSC acoustic measurement teams.

Radio 3, a multi-channel transceiver, was used as both an air-to-ground and ground-to-ground communications system. In air-to-ground mode it provided communications between VASI, helicopter flight crews, and noise test control on 123.175 MHz. In ground-to-ground mode it provided communications between the air traffic control tower (121.9 MHz), Page Avjet (the fuel source) (1??.95 MHz), and noise test control.

A schematic of this network is shown in Figure 4.1.

4.3 Local Media Notification - Noise test program managers working through the FAA Office of Public Affairs prepared an article for release to local media explaining that helicopter noise tests were to be conducted at Dulles Airport during the week of June 13, each test day commencing around dawn and extending through midday. The article described general test objectives, flight paths, and rationale behind the very early morning start time (low wind requirements). In the case of a farm located very close to the airport, a member of the program management team personally visited the residents and explained what was going to be involved in the test. As a consequence of these efforts (it is assumed), there were very few complaints about the test program.

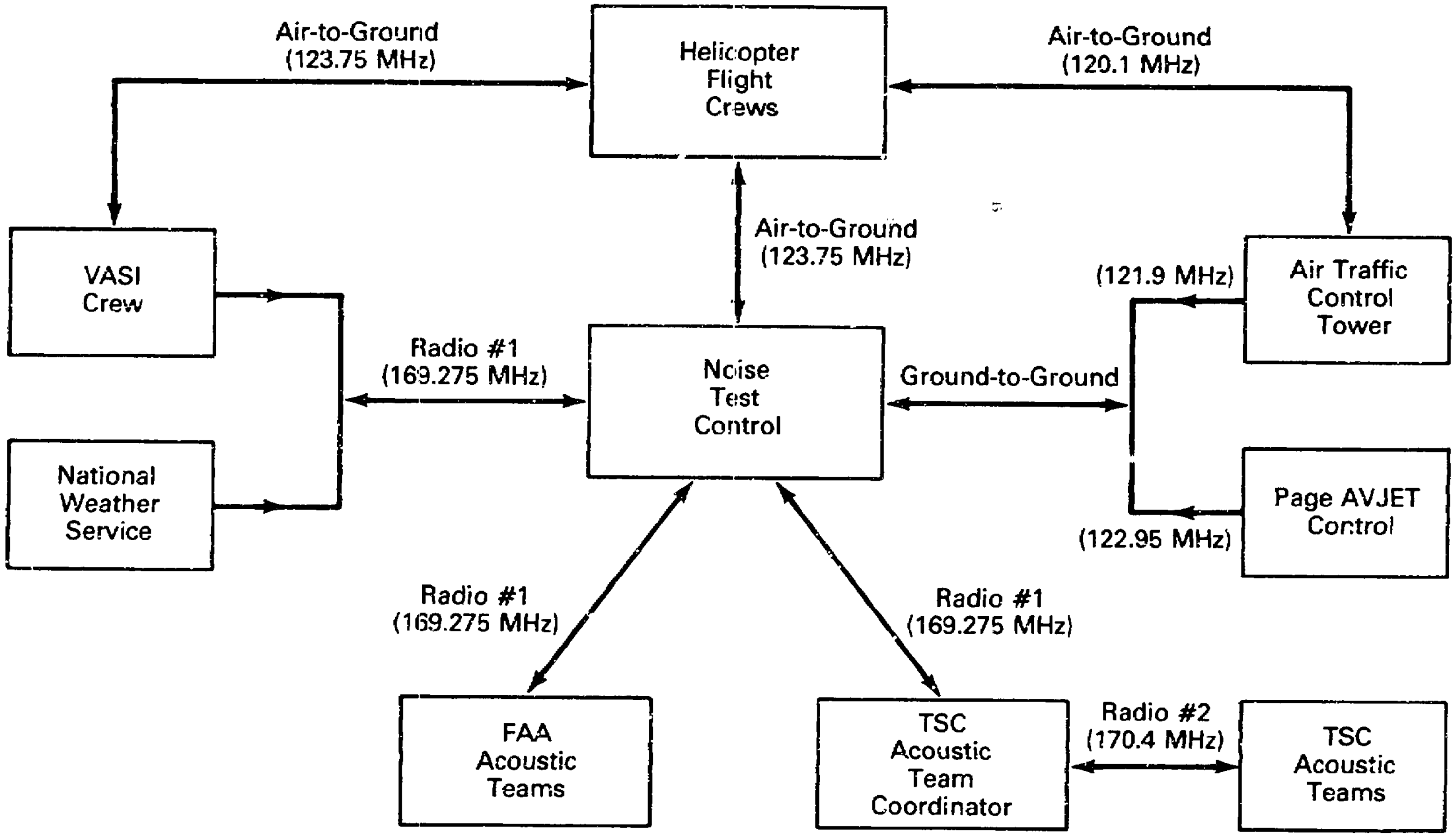
4.4 Ambient Noise - One of the reasons that the Dulles Runway 30 over-run area was selected as the test site was the low ambient noise level in the area. Typically one observed an A-Weighted LEQ on the order of 45 dB, with dominant transient noise sources primarily from the avian and insect families. The primary offender was the Collinus Virginianus, commonly known as the bobwhite, quail, or partridge. The infrequent intrusive

sound pressure levels were on the order of 55 dB within the 2000 Hz one-third octave band.

As an additional measure for safety and for lessening ambient noise, a Notice to Airmen or NOTAM was issued advising aircraft of the noise test, and indicating that Runway 12/30 was closed for the duration of the test.

Figure 4.1

Helicopter Noise Test Communication Network Schematic



5.0 Data Acquisition and Guidance Systems - This section provides a detailed description of the test program data acquisition systems, with special attention given to documenting the operational accuracy of each system. In addition, discussion is provided (as needed) which relates field experiences which might be of help to others engaged in controlled helicopter noise measurements. In each case, the location of a given measurement system is described relative to the helicopter flight path.

5.1 Approach Guidance System - Approach guidance was provided to the pilot by means of a visual approach slope indicator (VASI) and through verbal commands from an observer using a ballon-tracking theodolite. (A picture of the theodolite is included in Figure 3.1, in Section 3.0.) The VASI and theodolite were positioned at the point where the approach path intercepted the ground.

The VASI system used in the test was a 3-light arrangement giving vertical displacement information within ± 0.5 degrees of the reference approach slope. The pilot observed a green light if the helicopter was within 0.5 degrees of the approach slope, red if below the approach slope, white if above. The VASI was adjusted and repositioned to provide a variety of approach angles.

The theodolite system, used in conjunction with the VASI, also provided accurate approach guidance to the pilot. A brief time lag existed between the instant the theodolite observor perceived deviation, transmitted a command, and the pilot made the correction; however, the theodolite crew was generally able to alert the pilot of approach path deviations (slope and lateral displacement) before the helicopter exceeded the limits of the one degree green light of the VASI. Thus, the helicopter only

TABLE 5.1

REFERENCE HELICOPTER ALTITUDES FOR APPROACH TESTS
(all distances expressed in feet)

	MICROPHONE NO. 4	MICROPHONE NO. 1	MICROPHONE NO. 5
APPROACH ANGLE = 3°	A = 8010 B = 420 C = ±70	A = 7518 B = 394 C = ±66	A = 7026 B = 368 C = ±62
6°	A = 4241 B = 446 C = ±37	A = 3749 B = 394 C = ±33	A = 3257 B = 342 C = ±29
9°	A = 2980 B = 472 C = ±27	A = 2488 B = 394 C = ±22	A = 1362 B = 316 C = ±18

A = distance from VASI to microphone location

B = reference helicopter altitude

C = boundary of the 1 degree VASI glide slope "beam width".

occasionally and temporarily deviated more than 0.5 degrees from the reference approach path.

Approach paths of 6 and 9 degrees were used during the test program. Table 5.1 summarizes the VASI beam width at each measurement location for a variety of the approach angles used in this test.

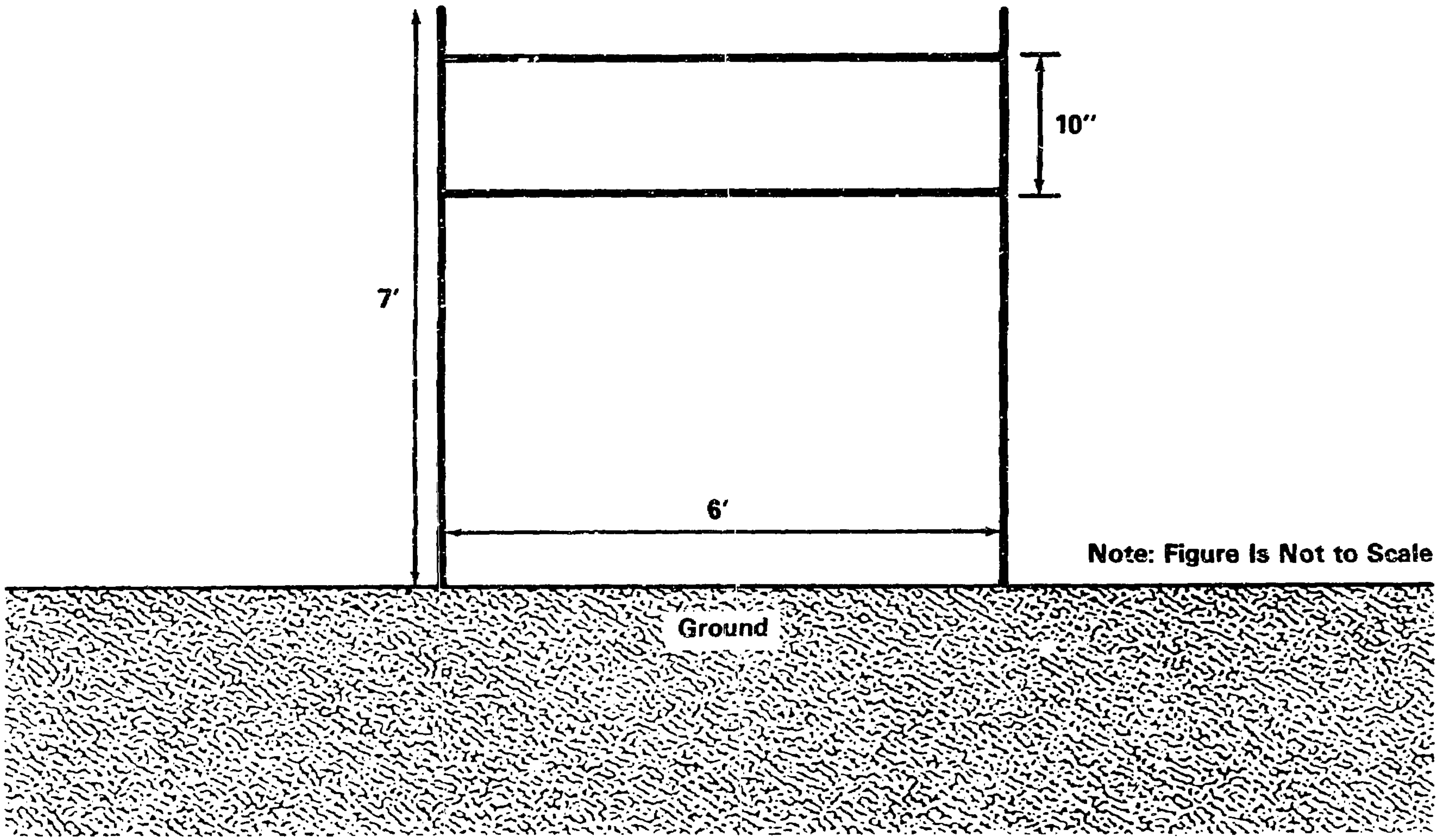
5.2 Photo Altitude Determination Systems - The helicopter altitude over a given microphone was determined by the photographic technique described in the Society of Automotive Engineers report AIR-902 (ref. 1). This technique involves photographing an aircraft during a flyover event and proportionally scaling the resulting image with the known dimensions of the aircraft. The camera is initially calibrated by photographing a test object of known size and distance. Measuring the resulting image enables calculation of the effective focal length from the proportional relationship:

(image length)/(object length)=(effective focal length)/(object distance)

This relationship is used to calculate the slant distance from microphone to aircraft. Effective focal length is determined during camera calibration, object length is determined from the physical dimensions of the aircraft (typically the rotor diameter or fuselage) and the image size is measured on the photograph. These measurements lead to the calculation of object distance, or the slant distance from camera or microphone to aircraft. The concept applies similarly to measuring an image on a print, or measuring a projected image from a slide.

Figure 5.1

Photo Overhead Positioning System (Pop System)



The SAE AIR-902 technique was implemented during the 1983 helicopter tests with three 35mm single lens reflex (SLR) cameras using slide film. A camera was positioned 100 feet from each of the centerline microphone locations. Lenses with different focal lengths, each individually calibrated, were used in photographing helicopters at differing altitudes in order to more fully "fill the frame" and reduce image measurement error.

The photoscaling technique assumes the aircraft is photographed directly overhead. Although SAE AIR-902 does present equations to account for deviations caused by photographing too soon or late, or by the aircraft deviating from the centerline, these corrections are not required when deviations are small. Typically, most of the deviations were acoustically insignificant. Consequently, corrections were not required for any of the 1983 test photos.

The photographer was aided in estimating when the helicopter was directly overhead by means of a photo-overhead positioning system (POPS) as illustrated in Figure 5.1. A picture of the POP system is also included in the photo collage (Figure 3.1) in Section 3.0. The POP system consisted of two parallel (to the ground) wires in a vertical plane orthogonal to the flight path. The photographer, lying beneath the POP system, initially positioned the camera to coincide with the vertical plane of the two guide wires. The photographer tracked the approaching helicopter in the viewfinder and tripped the shutter when the helicopter crossed the superimposed wires. This process of tracking the helicopter also minimized image blurring and the consequent elongation of the image of the fuselage.

A scale graduated in 1/32-inch increments was used to measure the projected image. This scaling resolution translated to an error in altitude of less than one percent. A potential error lies in the scaler's interpretation of the edge of the image. In an effort to quantify this error, a test group of ten individuals measured a selection of the fuzziest photographs from the helciopter tests. The resulting statistics revealed that 2/3 of the participants were within two percent of the mean altitude. SAE AIR-902 indicates that the overall photoscaling technique has a minimum (at its worst) accuracy of 12 percent which is equivalent to a maximum of 1 dB error in corrected sound level data. Actual accuracy varies from photo to photo; however, by using skilled photographers and exercising reasonable care in the measurements, the accuracy is good enough to ignore the resulting small error in altitude.

5.3 Cockpit Photo Data - During each flight operation of the test program, cockpit instrument panel photographs were taken with a 35mm SLR camera, with a 85mm lens, and high speed slide film. These pictures served as verification of the helicopter's speed, altitude, and torque at a particular point during a test event. The photos were intended to be taken when the aircraft was directly over the centerline-center microphone site, site #1 (see Figure 3.3). Although the photos were not always taken at precisely that point, the pictures do represent a typical moment during the test event. The word typical is important because the snapshot freezes instrument readings at one moment in time, while actually the readings are constantly changing by a small amount because of instrument fluctuation and pilot input. Thus, fluctuations above or below reference conditions are to be anticipated. A reproduction of a typical cockpit photo is shown in Figure 5.2. The use of video tape is being considered

for the future tests to acquire a continuous record of cockpit parameters. When slides were projected onto a screen, it was possible to read and record the instrument readings with reasonable accuracy. This data acquisition system was augmented by the presence of an experienced cockpit observor who provided additional documentation of operational parameters.

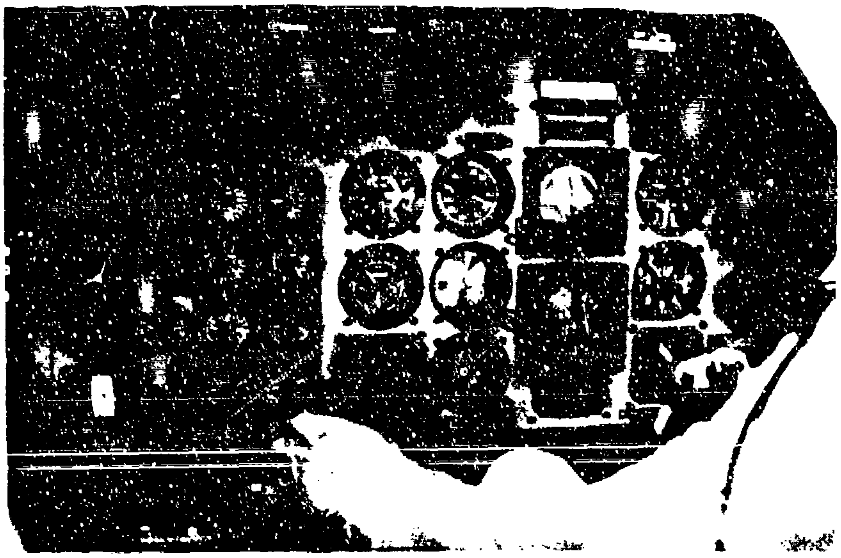


Figure 5.2

5.4 Upper Air Meteorological Data Acquisition/NWS: Sterling, VA - The National Weather Service (NWS) at Sterling, Virginia provided upper air meteorological data obtained from balloon-borne radiosondes. These data consisted of pressure, temperature, relative humidity, wind direction, and speed at 100' intervals from ground level through the highest test altitude. The balloons were launched approximately 2 miles north of the measurement array. To slow the ascent rate of the balloon, an inverted parachute was attached to the end of the flight train. The VIZ Accu-Lok (manufacturer) radiosonde employed in these tests consisted of sensors

which sampled the ambient temperature, relative humidity, and pressure of the air. Each radiosonde was individually calibrated by the manufacturer. The sensors were coupled to a radio transmitter which emitted an RF signal of 1680 MHz sequentially pulse-modulated at rates corresponding to the sampled meteorological parameters. These signals were received by the ground-based tracking system control circuitry and converted into a continuous trace on a strip chart recorder. The levels were then extracted manually and entered into a minicomputer, and the calculations were performed automatically. Wind speed and direction were determined from changes in position and direction of the "flight train" as detected by the radiosonde tracking system. Figure 5.3 shows technicians preparing to launch a radiosonde.

Figure 5.3

The manufacturer's specifications for accuracy are:

Pressure = ± 4 mb up to 250 mb

Temperature = ± 0.5°C, over a range of +30°C to -30°C

Humidity = ± 5% over a range of 25°C ± 5°C (20%-96%)

The National Weather Service has determined the "operational accuracy" of radiosonde (a documented in an unpublished report entitled "Standard for Weather Bureau Field Programs", 1-1-67) to be as follows:

Pressure = ± 2 mb, over a range of 1050 - 5 mb

Temperature = ± 1°C, over a range of +50°C to -70°C

Humidity = ± 5% over a range of +40°C to -40°C (10% to 100%)

The temperature and pressure data are considered accurate enough for our purposes. The relative humidity data are the least reliable. The radiosonde reports lower than actual humidities when the air is near saturation. These inaccuracies are attributable to the slow response time of the VIZ humidity sensor to sudden changes, (Ref. 2).

5.5 Surface Meteorological Data Acquisition/NWS: Dulles Airport - The National Weather Service Station at Dulles provided temperature, windspeed, and wind direction on the test day. Readings were noted every 15 minutes. These data are presented in Appendix H. The temperature transducers were located approximately 2.5 miles east of the test site at a height of 6 feet (1.8 m) above the ground, the wind instruments were at a height of 30 feet (10 m) above ground level. The dry bulb thermometer and dew point transducer were contained in the Bristol (manufacturer) HO-61 system operating with $\pm$ one degree accuracy. The windspeed and direction were measured with the electric speed indicator company F420C System, operating with an accuracy of 1 knot and ± 5° (maximum).

On-site meterological data were also obtained by TSC personnel using a Climatronics (manufacturer) model EWS weather system. The anemometer and temperature sensor were located 10 feet above ground level at noise site 4. These data are presented in Appendix I. The following table identifies the accuracy of the individual components of the EWS system.

Sensor	Accuracy	Range	Time Constant
Windspeed	±.025 mph or 1.5%	0-100 mph	5 sec
Wind Direction	±1.5%	0-360° Mech 0-540° Elect	15 sec
Relative Humidity	±2% 0-100% RH	0-100% RH	10 sec
Temperature	±1.0°F	-40 to +120°F	10 sec

After "detection" (sensing), the meteorological data are recorded on a Rustrak (manufacturer) paperchart recorder. The following table identifies the range and resolutions associated with the recording of each parameter.

Sensor	Range	Chart Resolution
Windspeed	0-25 TSC mod 0-50 mph	±0.5 mph
Wind Direction	0-540°	±5°
Relative Humidity	0-100% RH	±2% RH
Temperature	-40° to 120°F	±1°F

5.6.0 Noise Data Acquisition Sytems/System Deployment - This section provides a detailed description of the acoustical measurement systems employed in the test program along with the deployment plan utilized in each phase of testing.

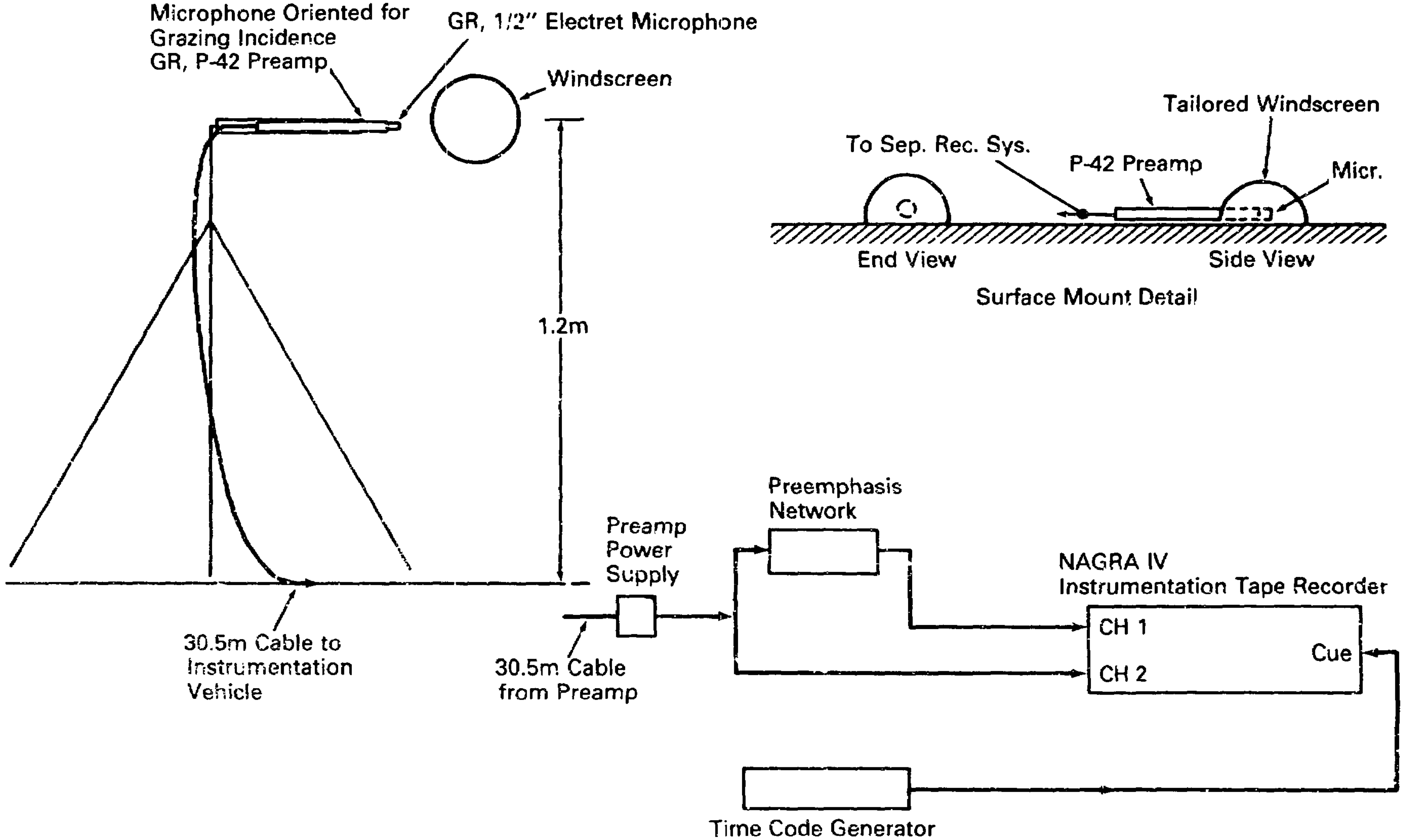
5.6.1 Description of TSC Magnetic Recording Systems - TSC personnel deployed Nagra two-channel direct-mode tape recorders. Noise data were recorded with essentially flat frequency response on one channel. The same input data was weighted and amplified using a high frequency pre-emphasis filter and was recorded on the second channel. The pre-emphasis network rolled off those frequencies below 10,000 Hz at 20 dB per decade. The use of pre-emphasis was necessary in order to boost the high frequency portion of the acoustical signal (such as a helicopter spectrum) characterized by large level differences (30 to 60 dB) between the high and low frequencies. Recording gains were adjusted so that the best possible signal-to-noise ratio would be achieved while allowing enough "head room" to comply with applicable distortion avoidance requirements.

IRIG-B time code synchronized with the tracking time base was recorded on the cue channel of each system. The typical measurement system consisted of a General Radio 1/2 inch electret microphone oriented for grazing incidence driving a General Radio P-42 preamp and mounted at a height of four feet (1.2 meters). A 100-foot (30.5 meters) cable was used between the tripod and the instrumentation vehicle located at the perimeter of the test circle. A schematic of the acoustical instrumentation is shown in Figure 5.4.

Figure 5.4 also shows the cutaway windscreen mounting for the ground microphone. This configuration places the lower edge of the microphone diaphram approximately one-half inch from the plywood (4 ft by 4 ft) surface. The ground microphone was located off center in order to avoid natural mode resonant vibration of the plywood square.

Figure 5.4

Acoustical Measurement Instrumentation



5.6.2 FAA Direct Read Measurement Systems - In addition to the recording systems deployed by TSC, four direct read, Type-1 noise measurement systems were deployed at selected sites. Each noise measurement site consisted of an identical microphone-preamplifier system comprised of a General Radio 1/2-inch electret microphone (1962-9610) driving a General Radio P-42 preamplifier mounted 4 feet (1.2m) above the ground and oriented for grazing incidence. Each microphone was covered with a 3-inch windscreen.

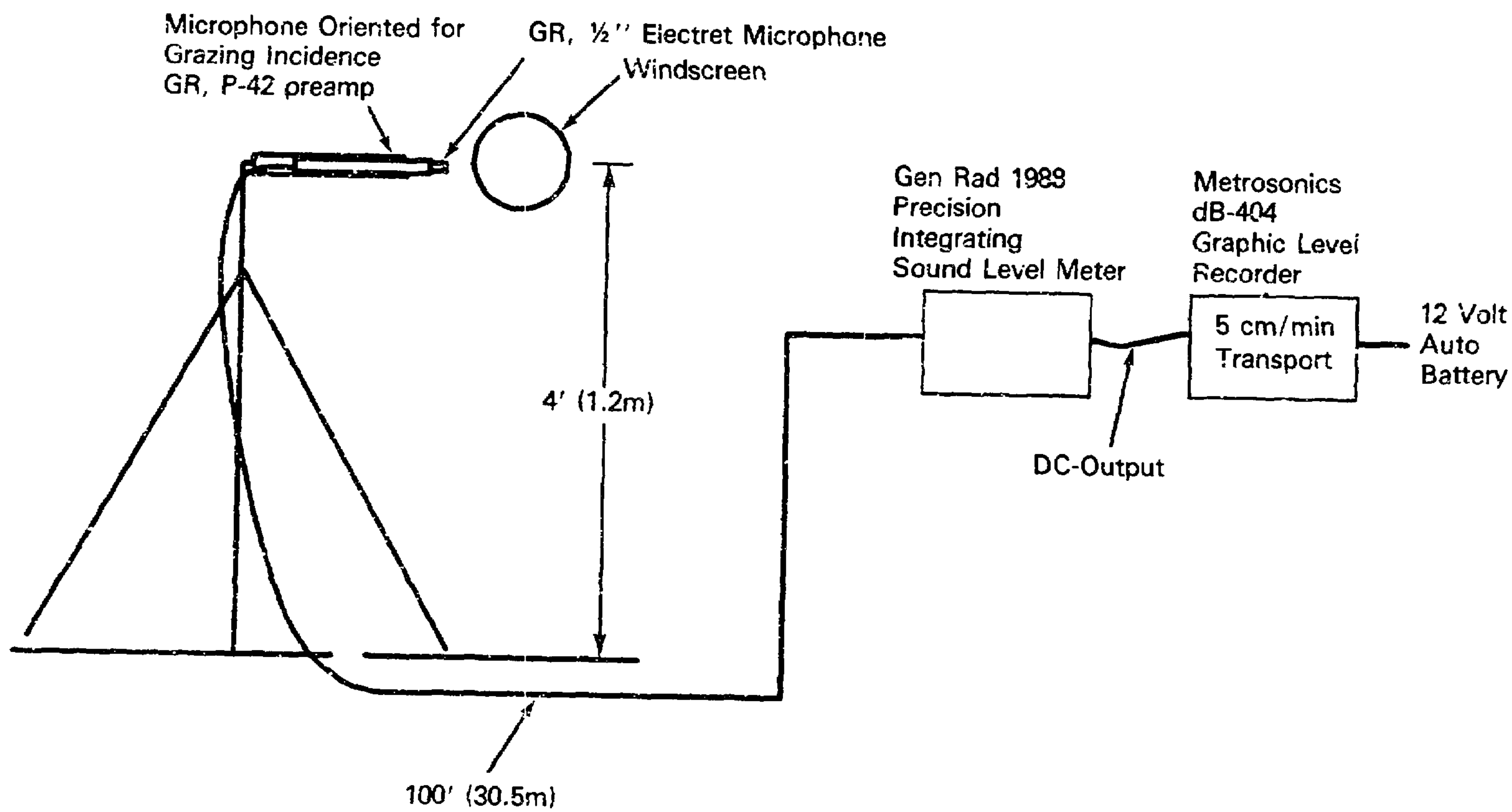
Three of the direct read systems utilized a 100-foot cable connecting the microphone system with a General Radio 1988 Precision Integrating Sooound Level Meter (PISLM). In each case, the slow response A-weighted sound level was output to a graphic level recorder (GLR). The GLRs operated at a paper transport speed of 5 centimeters per minute (300 cm/hr). These systems collected single event data consisting of maximum A-weighted Sound Level (AL), Sound Exposure Level (SEL), integration time (T), and equivalent sound level (LEQ).

The fourth microphone system was connected to a General Radio 1981B Sound Level Meter. This meter, used at site 7H for static operations only, provided A-weighted Sound Level values which were processed using a micro sampling technique to determine LEQ.

All instruments were calibrated at the beginning and end of each test day and approximately every hour in between. A schematic drawing of the basic direct read system is shown in Figure 5.5.

Figure 5.5

Acoustical Measurement Instrumentation



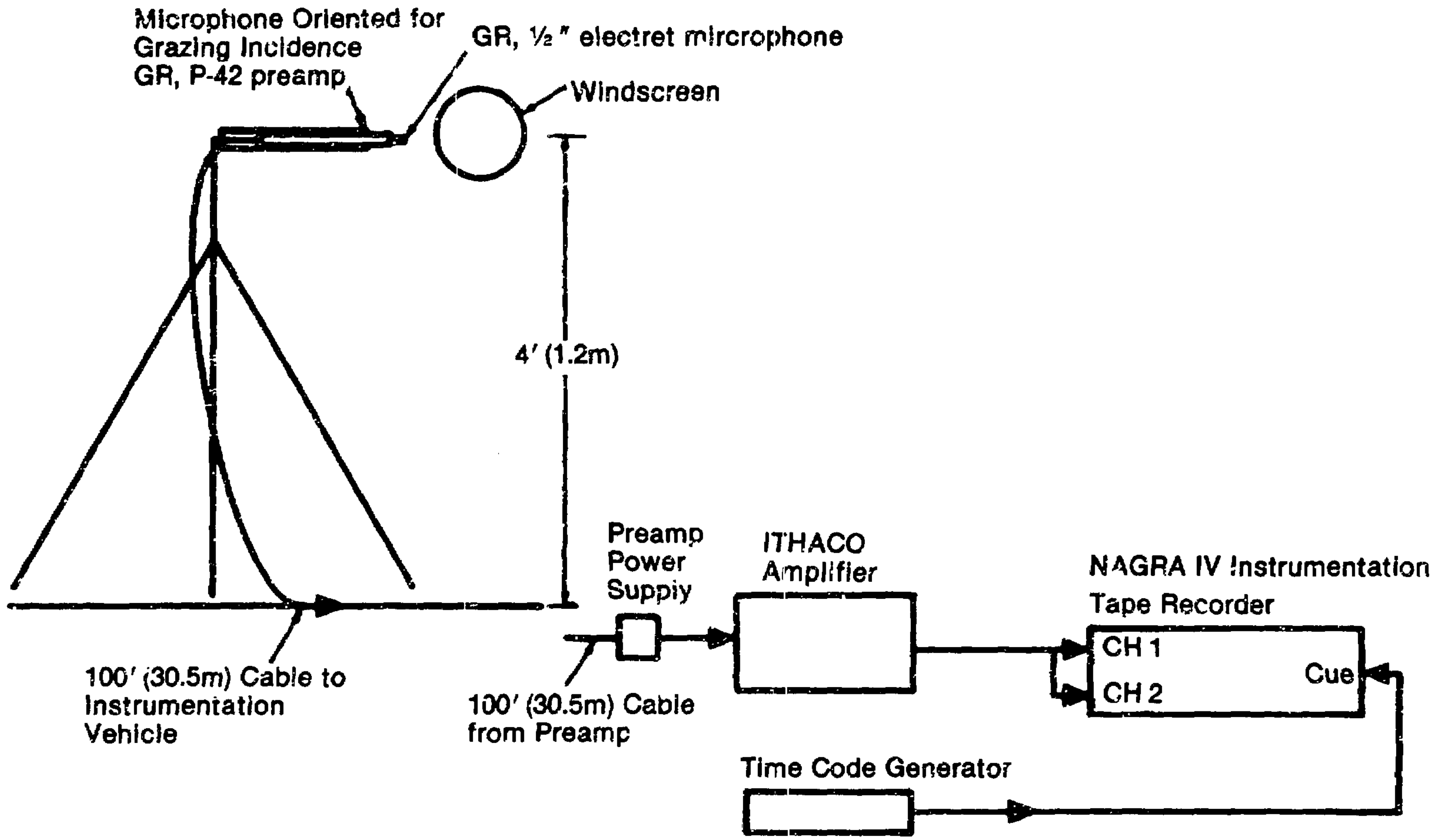
Direct Read Noise Measurement System

5.6.3 FAA Magnetic Recording System - On the third day of testing (see Section 5.6.4), an FAA mobile magnetic tape recording system was deployed at a single measurement site. This system consisted of the identical microphone pre-amplifier system used with the direct read noise measurement equipment described in the previous section. The microphone pre-amplifier system was connected by a 100-foot cable (30.5 m) to a two-channel Nagra IV-SJ magnetic tape recorder. Amplification was provided by an Ithaco model 451 amplifier. Data were recorded simultaneously on both channels in the linear mode. IRIG-B time code synchronized with field time was recorded on the cue channel. A schematic of the acoustical instrumentation is shown in Figure 5.6.

5.6.4 Deployment of Acoustical Measurement Instrumentation - This section describes the deployment of the magnetic tape recording and direct read noise measurement systems.

On the first two days of testing, TSC deployed six magnetic tape recording systems. During the flight operations, four of these recording system were located at the three centerline sites: one system at site 4, one at site 5, and two of the systems at centerline center with the microphone of one of those systems at 4 feet above ground, the microphone of the other at ground level. The two remaining recording systems were located at the two sidelines sites. The FAA deployed three direct read systems at the three centerline sites during the flight operations. Figure 5.7 provides a schematic drawing of the equipment deployment for the flight operations.

Figure 5.6
NAGRA Tape Recorder
Acoustical Measurement Instrumentation



In the case of static operations, only four of the six recorder systems were used. The recorder system with the 4-foot microphone at site 1 moved to site 1H. The recorders at sites 4 and 5 moved to 4H and 5H respectively. The recorder at site 2, the south sideline site, was also used. The three direct read systems were moved from the centerline sites to sites 5H, 2, and 4H. The fourth direct read system was employed at site 7H. Figure 5.8 provides a schematic diagram of the equipment deployment for the static operations.

After the second day of testing, the major portion of the program had been completed. Because of a questionable weather outlook and transportaion difficulties on the third day, it was determined that the remainder of the test would be conducted using an abbreviated acoustical array. It was deemed sufficient to use the four direct read noise measurement systems and one FAA magnetic tape recording system. The four direct read systems were located at the three centerline sites and site 3, the north sideline site. The magnetic tape recorder was located at site 2, the south sideline site. The deployment of this equipment is shown in Figure 5.9.

Figure 5.7

Microphone and Acoustical Measurement Instrument Deployment Flight Operations

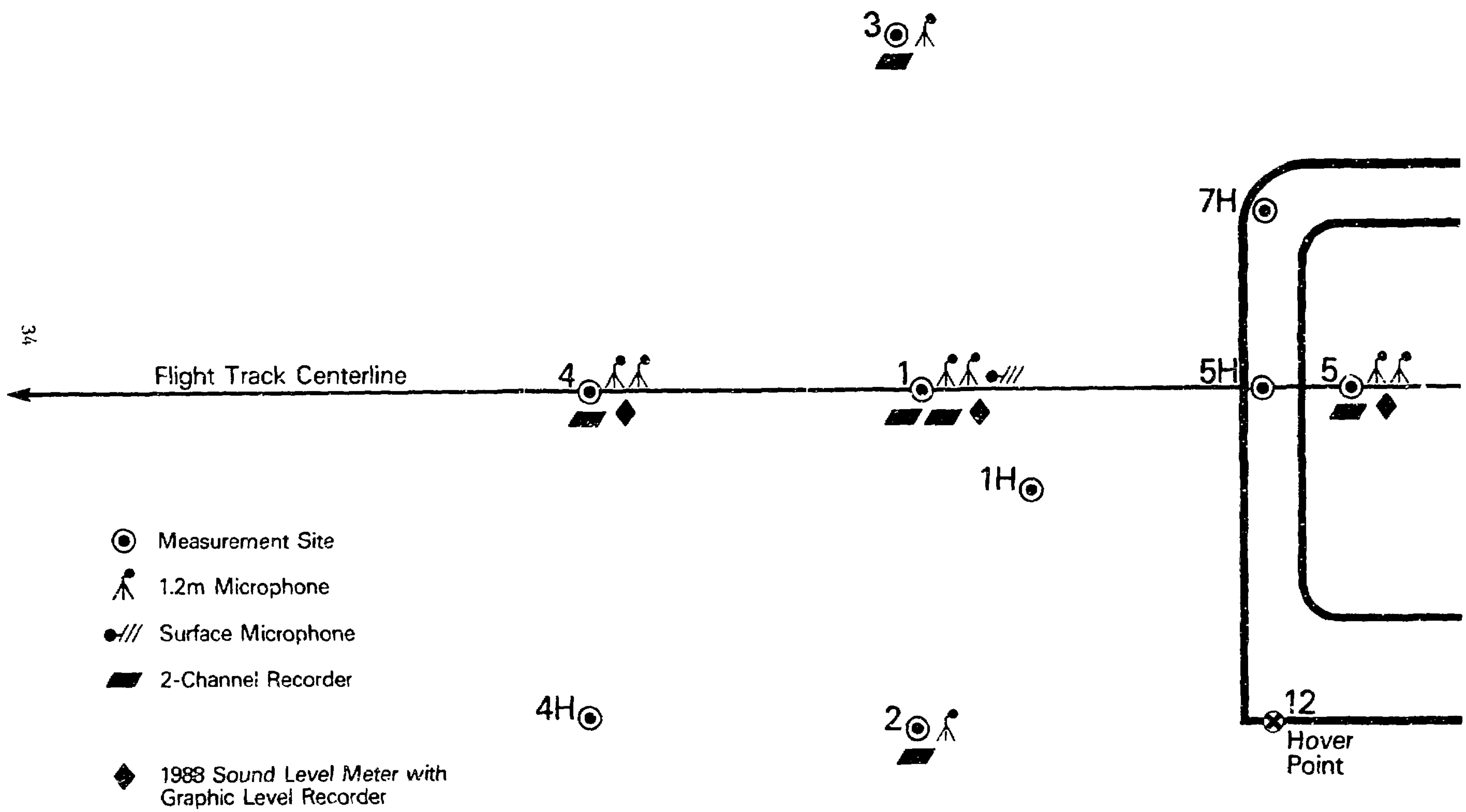


Figure 5.8

Microphone and Acoustical Measurement Instrument Deployment Flight Operations on 6-16-83

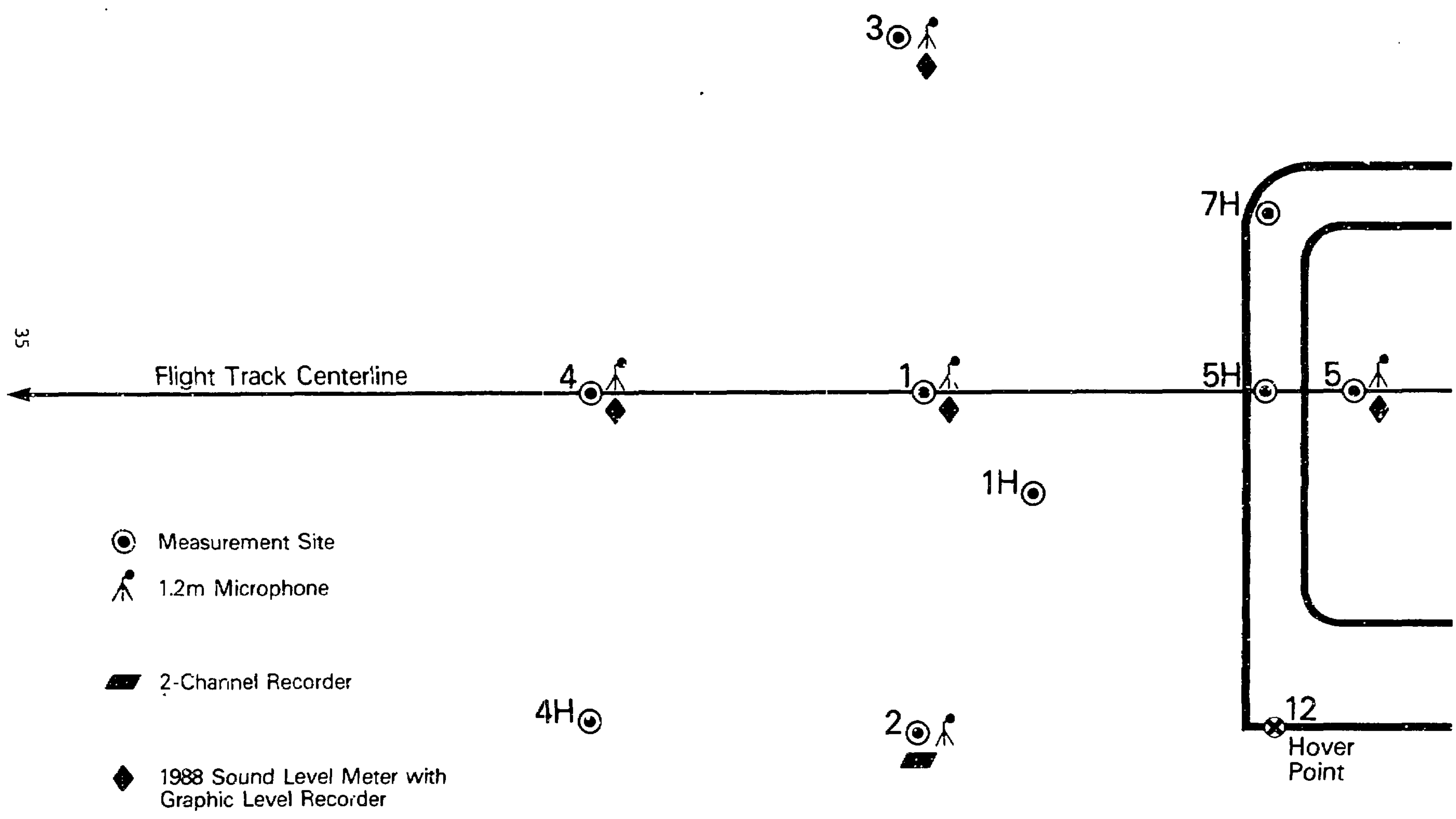
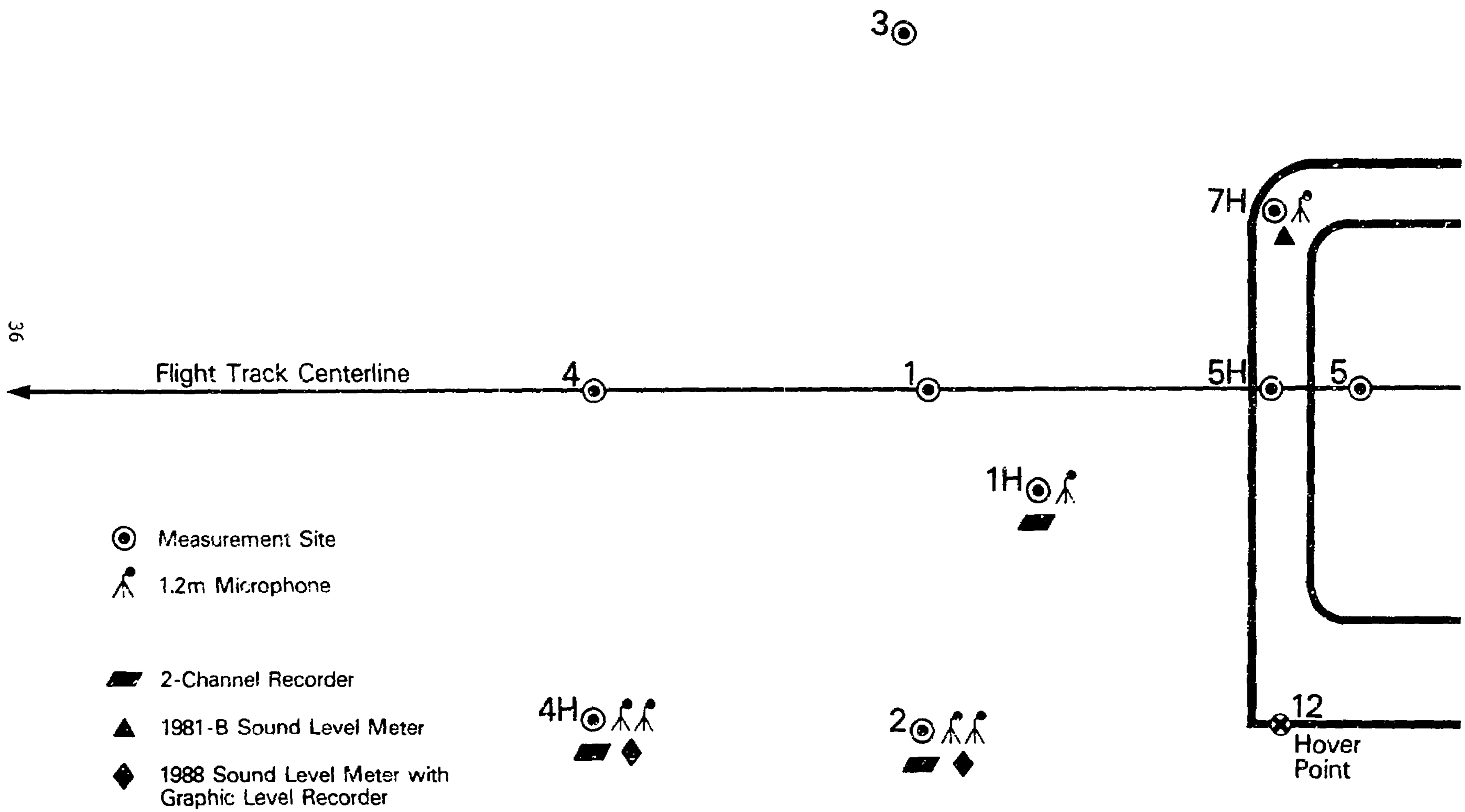


Figure 5.9

Microphone and Acoustical Measurement Instrument Deployment Static Operations



ACOUSTICAL DATA REDUCTION

6.0 Acoustical Data Reduction - This section describes the treatment of tape recorded and direct read acoustical data from the point of acquisition to point of entry into the data tables shown in the appendices of this document.

6.1 TSC Magnetic Recording Data Reduction - The analog magnetic tape recordings analyzed at the TSC facility in Cambridge, Massachusetts were fed into magnetic disc storage after filtering and digitizing using the GenRad 1921 one-third octave real-time analyzer. Recording system frequency response adjustments were applied, assuring overall linearity of the recording and reduction system. The stored 24, one-third octave sound pressure levels (SPLs) for contiguous one-half second integration periods making up each event comprise the base of "raw data." Data reduction followed the basic procedures defined in Federal Aviation Regulation (FAR) Part 36 (Ref. 3). The following sections describe the steps involved in arriving at final sound level values.

6.1.1 Ambient Noise - The ambient noise is considered to consist of both the acoustical background noise and the electrical noise of the measurement system. For each event, the ambient level was taken as the five to ten-second time averaged one-third octave band taken immediately prior to the event. The ambient noise was used to correct the measured raw spectral data by substracting the ambient level from the measured noise levels on an energy basis. This substraction yielded the corrected noise level of the aircraft. The following execptions are noted:

1. At one-third octave frequencies of 630 Hz and below, if the measured level was within 3 dB of the ambient level, the measured level was corrected by being set equal to the ambient. If the measured level was less than the ambient level, the measured level was not corrected.

2. At one-third octave frequencies above 630 Hz, if the measured level was within 3 dB or less of the ambient, the level was identified as "masked."

6.1.2 Spectral Shaping - The raw spectral data, corrected for ambient noise, were adjusted by sloping the spectrum shape at -2 dB per one-third octave for those bands (above 1.25 kHz) where the signal to noise ratio was less than 3 dB, i.e., "masked" bands. This procedure was applied in cases involving no more than 9 "masked" one-third octave bands. The shaping of the spectrum over this 9-band range was conducted to minimize EPNL data loss. This spectral shaping methodology deviates from FAR-36 procedures in that the extrapolation includes four more bands than normally allowed.

6.1.3 Analysis System Time Constant/Slow Response - The corrected raw spectral data (contiguous linear 1/2 second records of data) were processed using a sliding window or weighted running logarithmic averaging procedure to achieve the "slow" dynamic response equivalent to the "slow response" characteristic of sound level meters as required under the provisions of FAR-36. The following relationship using four consecutive data records was used:

$$L_i = 10 \text{ Log } [0.13(10^{0.1L_{i-3}})+0.21(10^{0.1L_{i-2}})+0.27(10.^{0.1L_{i-1}})+0.39(10.^{0.1L_i})]$$

where L_i is the one-third octave band sound pressure level for the ith one-half second record number.

6.1.4 Bandsharing of Tones - All calculations of PNLTM included testing for the presence of band sharing and adjustment in accordance with the procedures defined in FAR-36, Appendix B, Section B 36.2.3.3, (Ref. 4).

6.1.5 Tone Corrections - Tone corrections were computed using the helicopter acoustical spectrum from 24 Hz to 11,200 Hz, (bands 14 through 40). Tone correction values were computed for bands 17 through 40, the same set of bands used in computing the EPNL and PNLT. The initiation of the tone correction procedure at a lower frequency reflects recognition of the strong low frequency tonal content of helicopter noise. This procedure is in accordance with the requirements of ICAO Annex 16, Appendix 4, paragraph 4.3. (Ref. 5)

6.1.6 Other Metrics - In addition to the EPNL/PNLT family of metrics and the SEL/AL family, the overall sound pressure level and 10-dB down duration times are presented as part of the "As Measured" data set in Appendix A. Two factors relating to the event time history (distance duration and speed corrections, discussed in a later section) are also presented.

6.1.7 Spectral Data/Static Tests - In the case of static operations, thirty-two seconds of corrected raw spectral data (64 contiguous 1/2 second data records) were energy averaged to produce the data tabulated in Appendix D. The spectral data presented is "as measured" at the emission angles shown in Figure 6.1, established relative to each microphone location. Also included in the tables are the 360 degree (eight emission angles) average levels, calculated by both arithmetic and energy averaging.

Note that "masked" levels (see Section 6.1.1) are replaced in the tables of Appendix D with a dash (-). The indexes shown, however, were calculated with a shaped spectra as per Section 6.1.2.

6.2 FAA Direct Read Data Reduction - FAA direct read data was reduced using the Apple IIc microcomputer and the VISICALC® software package. VISICALC® Is an electronic worksheet composed of 256 x 256 rows and columns which can support mathematical manipulation of the data placed anywhere on the worksheet. This form of computer software lends itself to a variety of data analyses, by means of constructing templates (worksheets constructed for specific purposes). Data files can be constructed to contain a variety of information such as noise data and position data using a file format called DIF (data interchange format).

Data analysis can be performed by loading DIF files onto analysis templates. The output or results can be displayed in a format suitable for inclusion in reports or presentations. Data tables generated using these techniques are contained in Appendices C and E, and are discussed in Section 9.0.

6.2.1 Aircraft Position and Trajectory - A VISICALC® DIF file was created to contain the photo altitude data for each event of each test series for the test conducted. These data were input into a VISICALC® template designated HELO ALT. The template HELO ALT was designed to perform a 3-point regression through the photo altitude data from which estimates of aircraft altitudes could be determined for each microphone location.

6.2.2 Direct Read Noise Data - HELO NOISE was designed to take as input two VISICALC® DIF files. The first contained the "as measured" noise

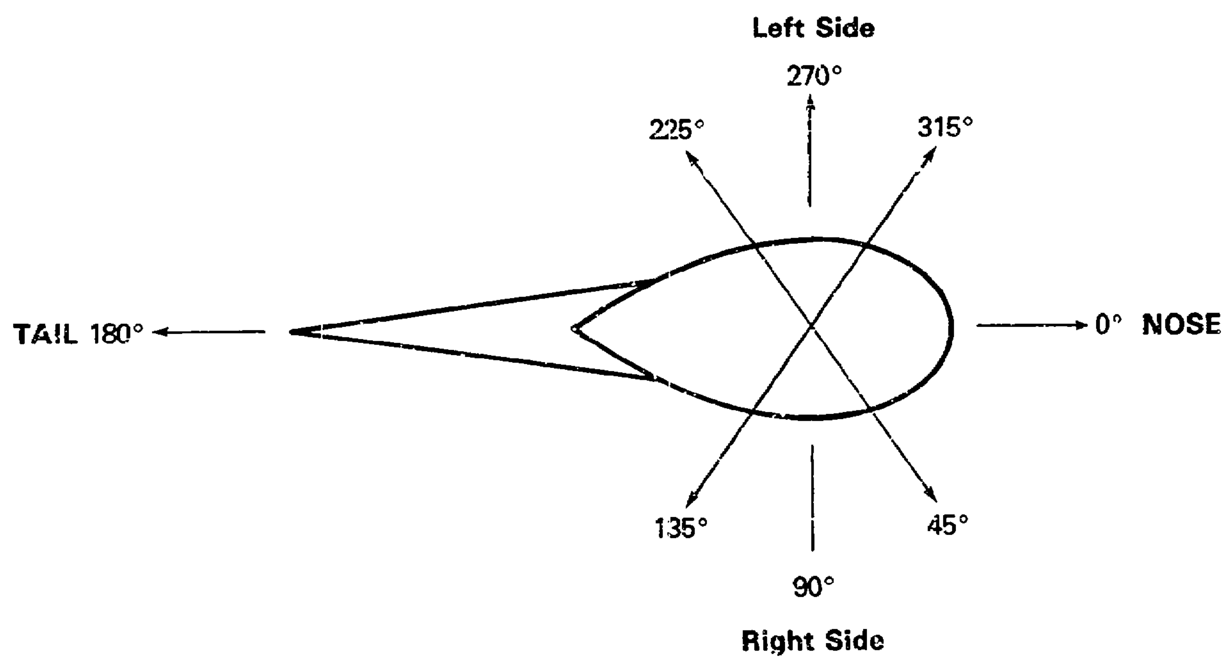
levels SEL and dBA obtained from the FAA direct read systems and the 10-dB duration time obtained from the graphic level recorder strips, for each of the three microphone sites.

The second consisted of the estimates of aircraft altitude over three microphone sites. HELO NOISE also performed calculations to determine two figures of merit related to the event duration influences on the SEL energy dose metric. This analysis is described in Section 9.4. All of the available HELO NOISE output templates are presented in Appendix C.

6.3 <u>FAA Magnetic Recording Data Reduction</u> - FAA noise data which were recorded on magnetic tape were input into a General Radio 1995 one-third octave analyzer. The analyzer filtered and digitized the data which were in turn input to a General Radio TDS-20 computer system and stored on an RKO-5 magnetic disc. These data were processed according to the procedures outlined in FAR Part 36 (and detailed in Section 6.1). These processed noise levels consisted of those values belonging to the EPNL/PNLT and SEL/AL families of acoustical metrics.

Figure 6.1

Acoustical Emission Angle Convention



7.0 Test Series Description - The first and core part of the noise measurement/flight test schedule for the Bell 222 included the ICAO noise certification operations (takeoff, approach, and level flyover) supplemented by level flyovers at various altitudes (at a constant airspeed) and at various airspeeds (at a constant altitude). The core test was rounded out by a series of static operations designed to assess helicopter directivity patterns and examine ground-to-ground propagation.

The second part, the elective test program, gave the helicopter manufacturer the opportunity to specify the operational regimes which best embody "Fly Neighborly" concepts. In addition, the manufacturer was invited to specify any other operations which might assist in establishing Fly Neighborly procedures or promote a better understanding of test limitations, acoustical propagation or other phenomena of interest.

Table 7.1 provides a summary of the test dates, test series, and operational description of the tests conducted on the Bell 222. Further information is included in Sections 7.1-7.3, which describe the Bell-222 test schedule by test series, each test series representing a group of similar events. Each noise event is identified by a letter prefix, corresponding to the appropriate test series, followed by a number which represents the numerical sequence of event (i.e., A1, A2, A3, A4, B5, B6). In the case of static operations, data are reported angle-referenced to each individual microphone location (i.e., J120, J165, J210, J255, J300, J345, J030, J75). Both Table 7.1 and the following test series descriptions specify "test target" values (provided by Bell Helicopter) for IAS and other parameters. Actual test run values are presented in Appendix F.

TABLE 7.1

TEST SUMMARY

Test Series	Operational Description	Test Date
A	1000' LFO IAS = 123 KTS	June 15
B	500' LFO IAS = 137 KTS	June 15
C	500' LFO IAS = 123 KTS	June 15
D	500' LFO IAS = 110 KTS	June 15
E	500' LFO IAS = 96 KTS	June 15
F	500' LFO IAS = 82 KTS	Omitted from Flight Plan
G	700' LFO IAS = 137 KTS	June 16
H	700' LFO IAS = 123 KTS	June 16
I	700' LFO IAS = 110 KTS	June 16
J	700' LFO IAS = 96 KTS	Omitted from Flight Plan
K	ICAO T/O	June 14
L	ICAO APP.	June 14
M	6 Deg App IAS = 45 KTS	June 14
N	6 Deg App IAS = 55 KTS	June 14
O	6 Deg App IAS = 75 KTS	June 14
P	6 Deg App IAS = 85 KTS	June 14
Q	Multi Segment APP	June 15, 16
R	Multi Segment APP	June 15
S	Multi Segment APP	June 15
T	12 Deg App IAS = 45 KTS	June 14
U	12 Deg App IAS = 55 KTS	June 14
V	12 Deg App IAS = 65 KTS	June 14
W	12 Deg App IAS = 75 KTS	June 14
X	Static (Hover-In-Ground-Effect)	June 14
Y	Static (Flight Idle/ Ground Idle)	June 14
Z	Static (Hover-Out-of-Ground-Effect)	June 14

7.1 Test Log for June 14 - The following paragraphs present the test series operational descriptions in chronological order beginning on Tuesday, June 14.

June 14: The test, slated to start at 5:45 am, was delayed due to low visibility. The decision was made to begin testing with static operations. After repositioning the measurement array, the test started at 6:41 am.

Test Series Y: Hover-in-ground effect, skid height approximately 5 feet above ground level. A one minute sample of noise data was acquired for each of eight directivity angles.

Test Series X: Flight Idle/Ground Operations, (skids on ground). Flight idle event numbers are followed by a lower case "a", while ground idle events are followed by a lower case "b", (i.e., X300, X300b). The flight idle operations were conducted with main rotor RPM at 100 percent, while ground idle operations reflected a 67 percent RPM value. A one-minute noise sample was acquired for flight idle RPM for each of eight directivity angles. In the case of ground idle operations, data were acquired for four directivity angles.

Test Series Z: Hover-out-of-ground-effect, skid height approximately 60 feet (18.28 meters). With main rotor RPM at 100 percent, a one-minute sample of noise data was acquired for each of eight directivity angles.

Test Series L: Runs L1, L2, L3, L4, L5, L6. Approach operations, flown on a heading of 120 degrees magnetic, with the helicopter passing over sites 4, 1, and 5 in succession. This series reflects ICAO certification requirements, which call for a 6 degree approach path at a constant target airspeed of 65 knots, (Vy, the speed for best rate of climb).

Test Series M: Runs M7, M8, M9. This series consisted of 6 degree approaches, virtually identical to series L except that a constant target airspeed of 45 knots was used.

Test Series N: Runs N10, N11, N12, N13. This series consisted of 6 degree approaches similiar to those in Series L and M, except that a constant target airspeed of 55 knots was used.

Test Series O: Runs O14, O15, O16. This series consisted of 6 degree approaches (as above) conducted at a constant target airspeed of 75 knots.

Test Series P: Runs P17, P18, P19. This series consisted of 6 degree approaches (as above) conducted at a constant target airspeed of 85 knots.

Test Series K: Runs K20, K21, K22, K23, K24, K25. This test series reflects ICAO certification takeoff test requirements. All takeoff operations were flown in the 300 degree direction, passing first over site 5, then sites 1 and 4. The airspeed requirement stipulates a constant velocity equal to Vy, which is 65 knots for the Bell-222.

Test Series T: Runs T26, T27, T28, T29. This test series consisted of 12 degree approaches conducted at a constant target airspeed of 45 knots.

Test Series U: Runs U30, U31, U32. This test series consisted of 12 degree approaches conducted at a constant target airspeed of 55 knots.

Test Series V: Runs V33, V34, V35. This test series consisted of 12 degree approaches conducted at a constant target airspeed of 65 knots.

Test Series W: Runs W36, W37, W38, W39, W40. This test series consisted of 12 degree approaches conducted at constant target airspeed of 75 knots.

This first day of testing ended at 1:15 pm.

7.2 Test Log for June 15. The second day of testing, Wednesday, June 15, began with the same conditions of haze and fog which delayed the previous day's testing. After several false starts and a near cancellation, the test got underway at 1:00 pm. The test event numerical sequence was started over with Number 1, rather than picking up with Number 41, the last number of the first day.

Test Series A: Runs A1, A2, A3, A4, A5, A6. This series consisted of level flyovers at a target altitude of 1000 feet (304.8 meters) above ground level (AGL), at a target airspeed of 123 knots, 90 percent of Vne, the never-exceed velocity. All level flyovers in this test were conducted on a heading of 120 degrees.

Test Series B: Runs B7, B8, B9. This series consisted of level flyovers at a altitude of 500 feet AGL (152.4 meters) at a target airspeed of Vne, 137 knots.

Test Series C: Runs C10, C11, C12, C13, C14, C15. This series consisted of level flyovers at a target altitude of 500 feet AGL, at a target airspeed of 123 knots, 90 percent of Vne.

Test Series D: Runs D16, D17, D18. This series consisted of level flyovers at a target altitude of 500 AGL, at a target airspeed of 110 knots, 80 percent of Vne.

Test Series E: Run E19. Because of the limited time remaining due to late start and increasing air traffic only one event in this series was conducted. This event consisted of a single, level flyover at a target altitude of 500 feet AGL, and a target airspeed of 96 knots.

Test Series Q, R, and S: Runs Q20, Q21, R22, and S23. These three test series were defined as experimental multi-segment approaches. Each event was characterized by a different rate of descent, torque, and airspeed. In some cases there was deceleration taking place during the event.

The second day of testing ended at 2:30 pm.

7.3 Test Log for June 16 - The third day of testing, Thursday, June 16, began, as did the previous two days, hazy with visibility under three miles. After considerable delay the test got under way at about 10:45 am.

Test Series Q: Runs Q24 through Q44. This series represents a continuation of the experimental multi-segment approaches (series Q, R, and S) conducted on the 15th. Section 8.0 includes a discussion of variation in noise levels with approach operation parameters.

Test Series G: Runs G41, G42, G43, G44. This test series was comprised of level flyovers on a heading of 120 degrees at a target altitude of 700 feet AGL and a target airspeed of 137 knots.

Test Series H: This test series was comprised of level flyover in the 120 degree direction at a target altitude of 700 feet AGL and a target airspeed of 123 knots.

Test Series I: Runs I48 and I49. This test series consisted of level flyovers in the 120 degree direction at a target altitude of 700 feet AGL and a target airspeed of 110 knots.

The third test day ended at 12:30 in the afternoon.

8.0 Documentary Analyses/Processing of Trajectory and Meteorological Data - This section contains analyses which were performed to document the flight path trajectory and upper air meteorological characteristics (as a function of time) during the Bell 222 test program.

8.1 Photo-Altitude Flight Path Trajectory Analyses - Data acquired from the three centerline photo-altitude sites were processed on an Apple IIe microcomputer using a VISICALC® (manufacturer) electronic spread sheet template developed by the authors for this specific application. The scaled photo-altitudes for each event (from all three photo sites) were entered as a single data set. The template operated on these data, calculating the straight line slope in degrees between the helicopter position over each pair of sites. In addition, a linear regression analysis was performed in order to creat a straight line approximation to the actual flight path. This regression line was then used to compute estimated altitudes and CPA's (Closest Point of Approach) referenced to each microphone location (Note: Photo sites were offset from microphone sites by 100 feet). The results of this analysis are contained in the tables of Appendix G.

Discussion - While the photo-altitude data do provide a reasonable description of the helicopter trajectory and provide the means to effect distance corrections to a reference flight path (not implemented in this report), there is the need to exercise caution in interpretation of the

data. The following excerpt makes an important point for those trying to relate the descent profiles (in approach test series) to resulting acoustical data.

> In our experience, attempts by the pilot to fly down a very narrow VASI beam produce a continuously varying rate of descent. Thus while the mean flight path is maintained within a reasonable degree of test precision, the rate of descent (important parameter connected with blade/vortex interactions) at any instant in time may vary much more than during operational flying. (Ref. 6)

Further, care is necessary when using the regression slope and the regression estimated altitudes; one must be sure that the site-to-site slopes are similiar (approximate constant angle) and that they are in agreement with the regression slope. If these slopes are not in agreement, then use photo altitude data along with the site-to-site slopes in computations.

8.2 Upper Air (500-2000 ft) Meteorological Data - This section documents the coarse variation in upper air meteorological parameters as a function of time for the June 14 test program. The timing delays encountered in conducting the measurement program on June 15 and June 16 led to complications resulting in an absence of upper air data on those two days.

The National Weather Service office in Sterling, Virginia provided preliminary data processing resulting in the data tables shown in Appendix H. Supplementary analyses were then undertaken to develop time histories of various parameters over the period of testing for selected altitudes. Each time history was constructed using least square linear regression techniques for the five available data points (one for each launch). The plots attempt to represent the gross (macro) meteorological trends over the test period.

Temperature - Figure 8.1 presents the time history analysis for temperature. In this plot one can observe nearly constant temperatures at 1000 and 2000 feet above ground level with a gradual warming trend at the 500 foot level. It is worth noting that a shallow (2-degree) temperature inversion persisted between 500 and 1000 feet throughout the first four hours of testing. This minor inversion is not considered a significant influence on propagation.

Relative Humidity - In the case of relative humidity, shown in Figure 8.2, one observes a fall off in humidity with 500 and 2000 feet with an increase level at 1000 feet. It is significant to note that the variation in humidity at 500 and 1000 feet over the duration of the test falls within the 45 to 55 percent range. This degree of stability in the

temperature-relative humidity pair results in relatively stable atmospheric absorption characteristic throughout the test. This in turn suggests that atmospheric absorption corrections required in FAR-36 or ICAO Annex 16 (referred to as the Delta-1 correction) would tend to be of similiar magnitude for events conducted at different times.

From the perspective of atmospheric absorption, it appears that conditions within the air mass in the test vicinity were typical, relatively stable, and displayed the variations one would expect with the daily summer burn off of surface moisture and the dissipation of the inversion layer.

Wind Vector - The data shown in Figures 8.3 and 8.4 depict the along-track and cross-track wind vector components showing variation as a function of time for the three altitudes considered. In order to assess the head, tail, and cross wind influences on a single event one must first establish the direction of travel. This can be determined by examination of the cockpit data contained in Appendix F. At 500 and 1000 foot altitudes one observes maximum crosswind components (7 to 10 knots) around 7:00 to 8:00 am, with lesser values at other times. It is interesting to note the shift in wind direction between 500 feet and higher altitudes.

Again, during the 7:00 to 8:00 am period, one observes the strongest headwind/tailwind component reaching approximately 10 knots at an altitude of 500 feet. It is interesting to note the very low on-track wind present at altitudes above 500 feet.

Discussion - In the context of a noise measurement/flight test one attempts to avoid so-called anomalous meteorological conditions, (see ref. 3) a concept that is difficult to define. In the initial paragraphs of this section, the topic of atmospheric absorption was addressed, concluding with a statement about the apparent stability in values.

Although the reasons behind the requirement to avoid "anomalous conditions" arose from concerns involved with atmospheric absorption, one might extend the requirement to include concerns for smooth flight, and normal attitudinal operation of the helicopter. While extreme cross wind components and/or strong shifts in wind in the vicinity of the test site might suggest the presence of buffeting or turbulence, it is primarily the pilot's reported ease or difficulty in flying the helicopter which identifies a potential problem. While the data do suggest the presence of variation in wind speed and direction, they do not connote an extreme condition which might lead to concern.

As a final note, the influence of wind on blade-vortex interactions (a strong function) cannot be completely addressed using the data presented in this section. Rather, it is necessary to acquire data virtually concurrent with the flight operations and in very close proximity to the test helicopter. It is anticipated that future tests will employ tethered balloon systems deployed in close proximity to the test area.

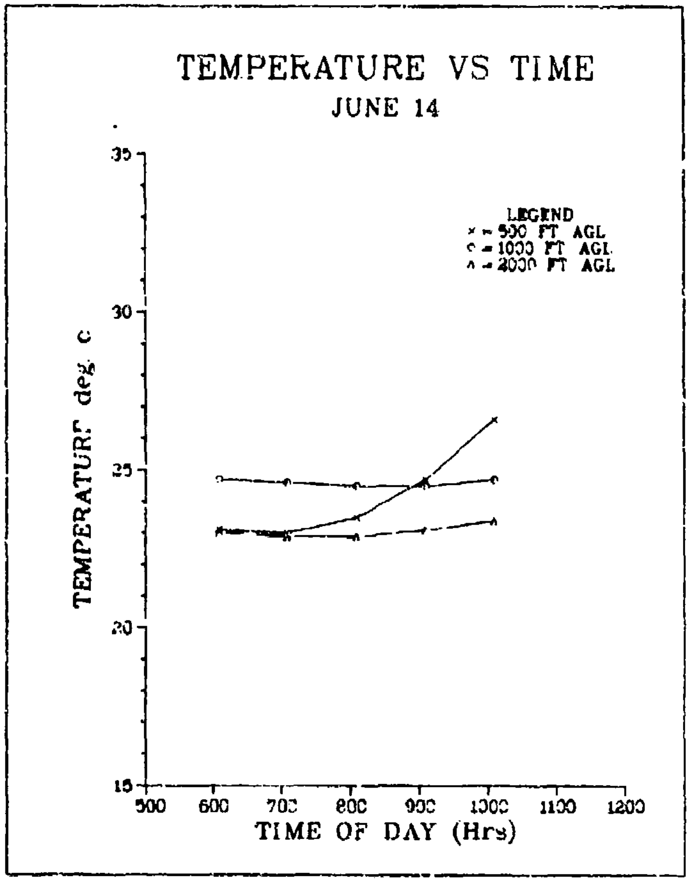


Figure 8.1

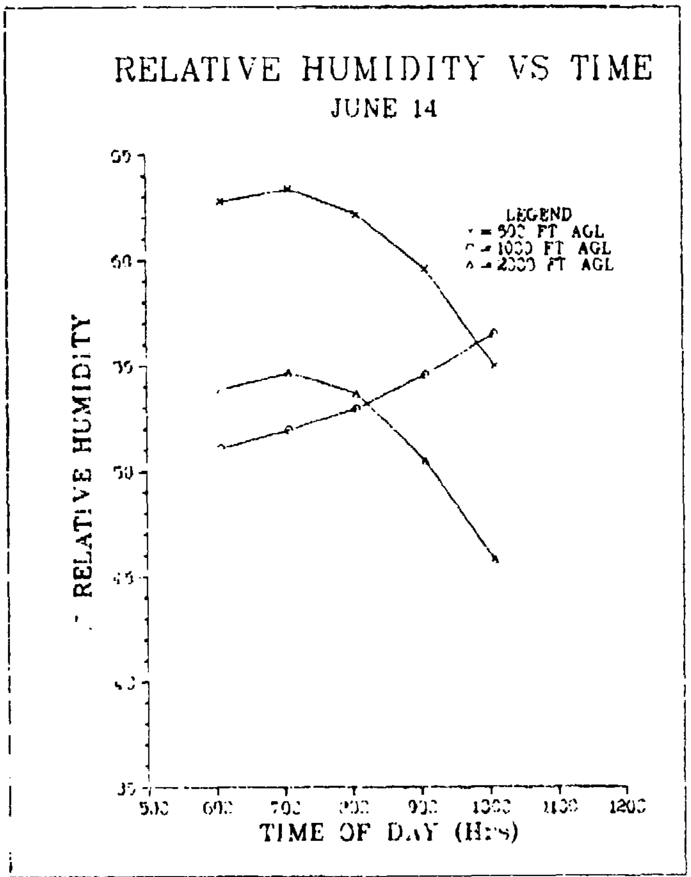


Figure 8.2

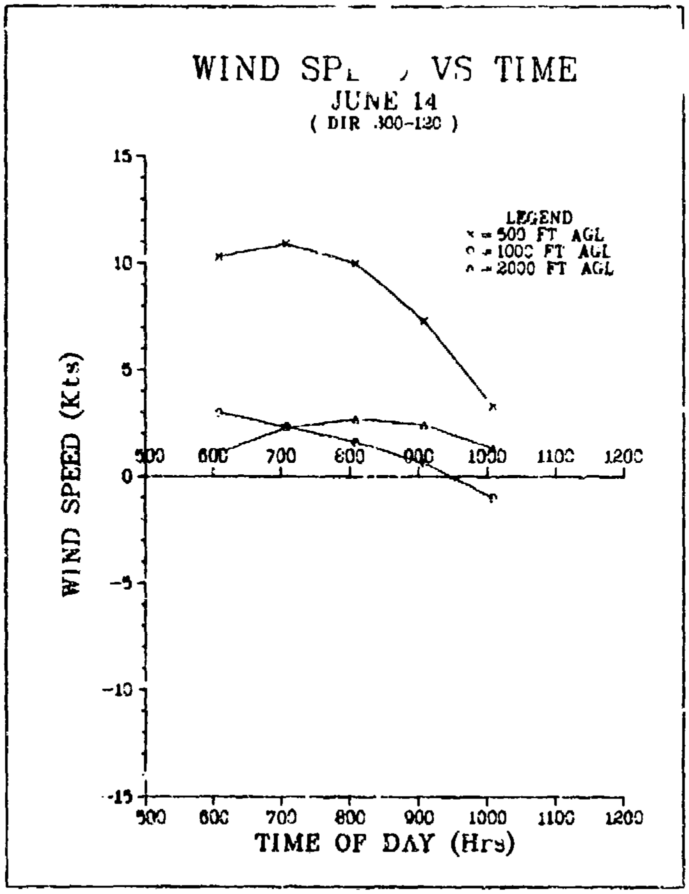


Figure 8.3

HEAD/TAIL WIND

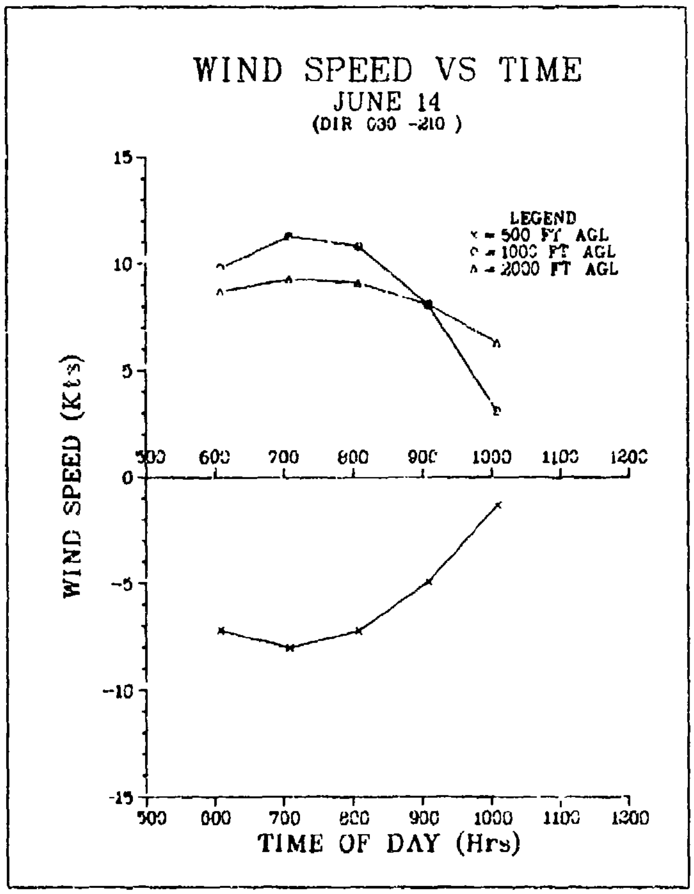


Figure 8.4

CROSS WIND

EXPLORATORY ANALYSES AND DISCUSSIONS

9.0 Exploratory Analyses and Discussion - This section is comprised of a series of distinct and separate analyses of the data acquired with the Bell 222 test helicopter. In each analysis section an introductory discussion is provided describing pre-processing of data (beyond the basic reduction previously described), followed by presentation of either a data table or graph(s), or reference to appropriate appendices. Each section concludes with a discussion of salient results and presentation of conclusions.

The following list identifies the analyses which are contained in this section.

9.1 Variation in noise levels with airspeed for level flyover operations

9.2 Static data analysis: source directivity and hard vs. soft propagation characteristics

9.3 Comparison of noise data: 4-foot vs. ground microphones

9.4 Duration effect analysis

9.5 Analysis of variability in noise levels for two sites equidistant over similar propagation paths

9.6 Variation in noise levels with airspeed and rate of descent for approach operations

9.7 Variation in noise levels for multi-segment approachs

9.8 Analysis of ground-to-ground acoustical propagation for a nominally soft propagation path

9.9 Acoustical propagation analysis/discussion of variability

9.1 Variation in Noise Levels with Airspeed for Level Flyover Operations - This section analyzes the variation in noise levels for level flyover operations as a function of airspeed. Data acquired from the centerline-center location (site 1) TSC recorder system have been utilized in this analysis. All data are "as measured", uncorrected for the minor variations in altitude from event to event.

The data scatter plotted in Figures 9.1 through 9.4 represent individual noise events for each acoustical metric. The line in each plot links the average observation at each target airspeed. The line does not extend to 96 knots as only one data point was available at that speed.

Discussion - The plots show the general trend that can be expected with an increase in airspeed during level flyover operations. It has been observed that as a helicopter increases its airspeed, two acoustically-related events take place. First, the noise event duration is decreased as the helicopter passes more quickly. Second, the source acoustical emission characteristics change. These changes reflect the aerodynamic effects which accompany an increase in speed. At speeds higher than the speed for minimum power, the power required increases with an increase in airspeed. These influences lead to a noise-intensity-versus-airspeed relationship which can be approximated by a parabolic curve. The steep upturn in noise level generally observed at higher speeds is a consequence of advancing blade tip Mach number effects, which result in impulsive noise.

Figure 9.5 shows the parabolic nature of data collected for one test helicopter for a series of 500' level flyovers with a indicated airspeed range of 90-150 kts, taken from an earlier series of tests.

In the case of the Bell 222, the noise versus indicated airspeed plots tend to reflect a linear approximation to a parabola, possible due to lower helical tip Mach numbers during its flight regime. It is thought that the Bell 222 data reflect a situation where the parabola has reached its minimum value and has started to turn up; however, the airspeeds and related advancing tip Mach numbers have not yet reached the region of steep increases in noise with increased airspeed. Thus, one observes a first order relationship between noise level and airspeed.

BELL 222 500 FT LEVEL FLYOVER DATA

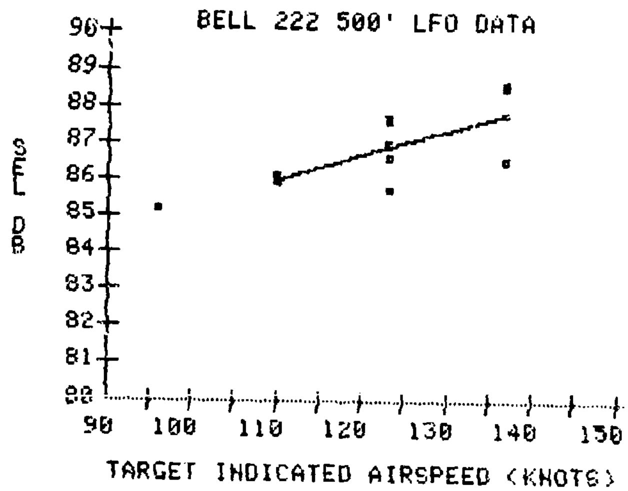


Figure 9.1

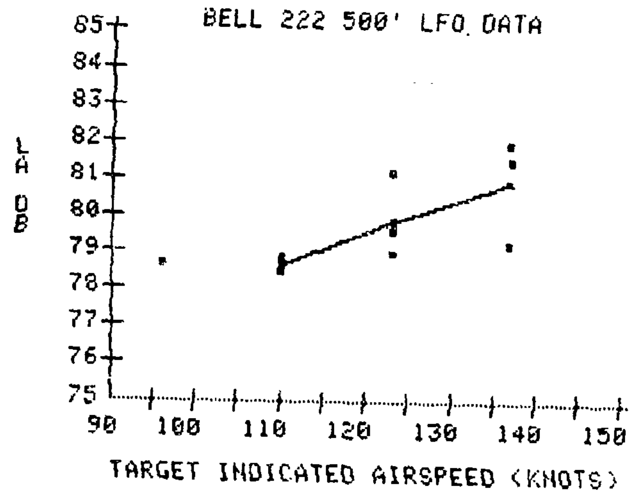


Figure 9.2

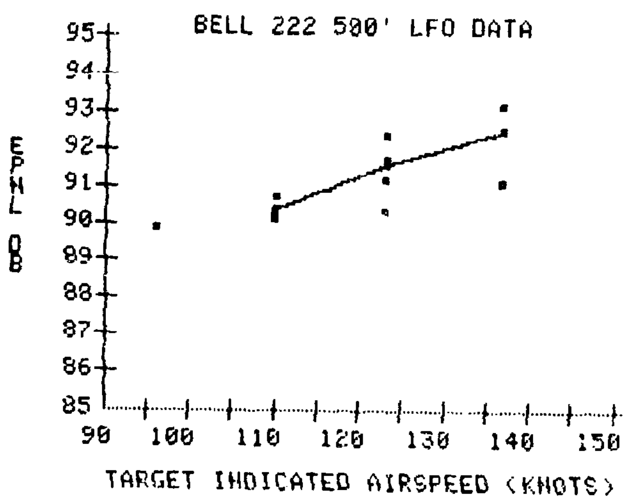


Figure 9.3

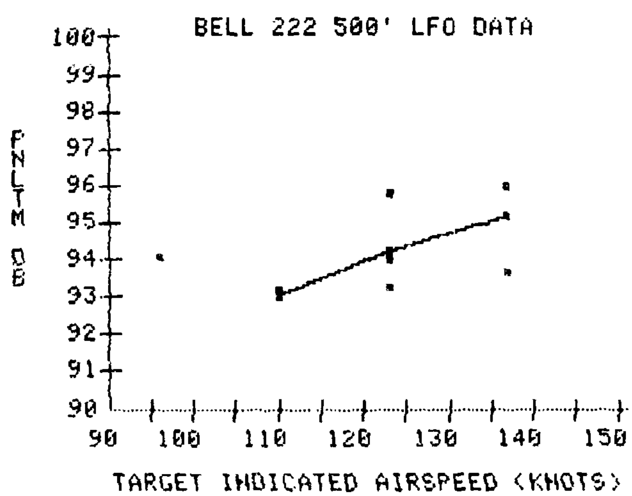
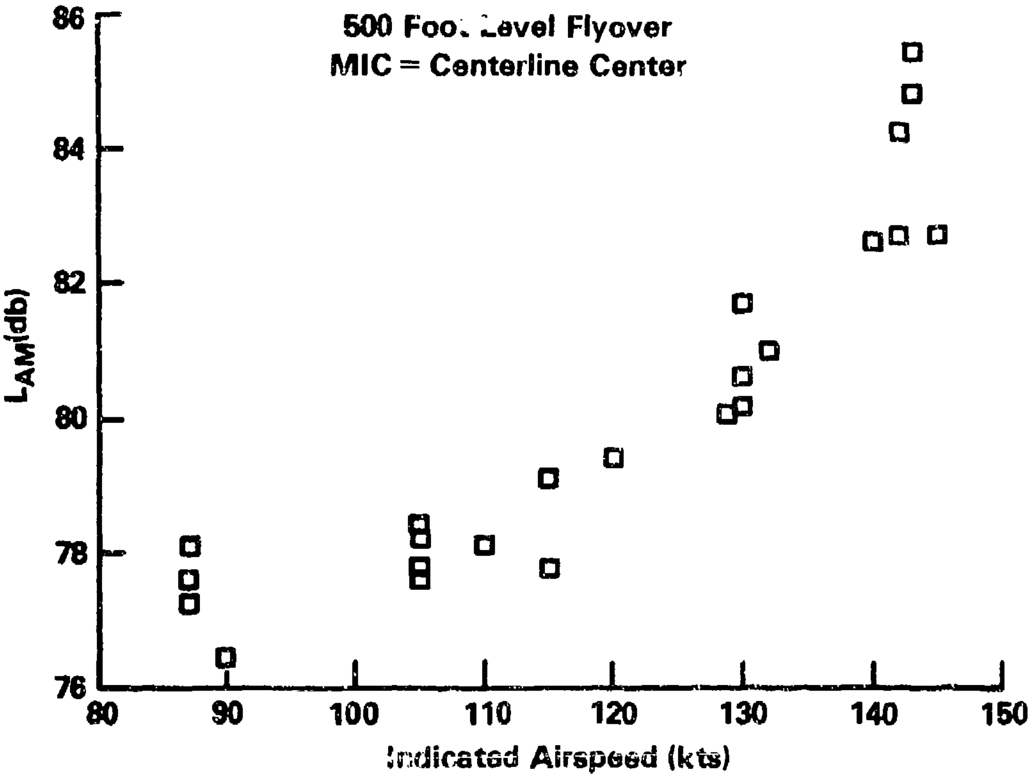


Figure 9.4

Figure 9.5

Helicopter Noise Measurement Data

(June 24, 1980 Ref. Table A.3-2.1)



9.2 Static Operations: Analysis of Source Directivity and Hard vs. Soft Path Propagation Characteristics - This analysis is comprised of two principal components. First, the plots shown in Figures 9.6 through 9.9 depict the time averaged directivity patterns for various static operations for measurement sites located equidistant from the hover point. The second component involves the fact that one of the two sites lies separated from the hover point by a hard asphalt surface, while the other site is separated from the hover point by a soft grassy surface. The difference in the propagation of sound over the two disparate surfaces is reflected in the difference between the upper and lower curves in each plot.

Time averaged (approximately 60 seconds) data are shown for acoustical emission directivity angles (see Figure 6.1) established every 45 degrees from the nose of the helicopter (zero degrees), in a clockwise fashion. Data plotted in these figures can be found in Appendix D for microphones 5H and 2.

Discussion - The plots contained in this analysis dramatically portray the highly directive nature of the Bell 222 acoustical radiation pattern for static operations. Further, this analysis reveals a spacially averaged difference of 4 to 6 dB in sound levels for sites located 500 feet from a helipad, with one site over a soft surface and the other over a hard surface. Another significant observation is the marked maximum observed in the radiation pattern off the left side of the helicopter. This increase in noise level is likely associated with the influence of the tail rotor, located on the left side of the tail cone. In each case discussed below, observations concerning noise impact and acceptability are based on consideration of typical urban/community ambient noise

levels and the levels of urban transportation noise sources. In general, the interpretation of environmental impact requires careful consideration of the ambient sound levels in the vicinity of the specific heliport under consideration.

<u>Discussion: Hover in Ground Effect (HIGE)</u> - The HIGE data plot, Figure 9.6, shows the marked left side directivity pattern mentioned above. The sound level values, in the lower to mid 70's for the hard path (at 500 feet), can in some situations present an environmental noise problem. On the other hand, the soft path values range in the mid 60's, values which are less of a concern (for short durations) in an urban environment. The point is that there exists a significant advantage in situating a heliport in a location where noise sensitive areas are separated from the heliport by an acoustically absorbent surface such as grass.

<u>Discussion: Hover Out of Ground Effect (HOGE)</u> - The comments made above certainly apply as well in the case of HOGE, a transitional flight regime, shown in Figure 9.7. The sound levels (AL), in the vicinity of 80 dB, are invariably of short duration, being associated with ingress/egress operations.

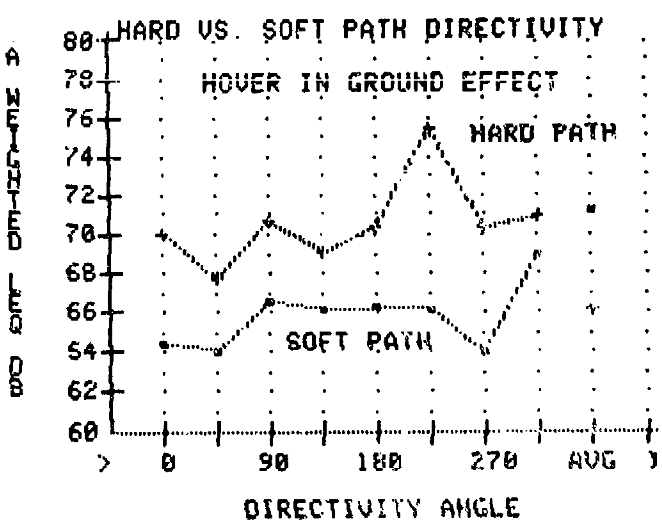


Figure 9.6

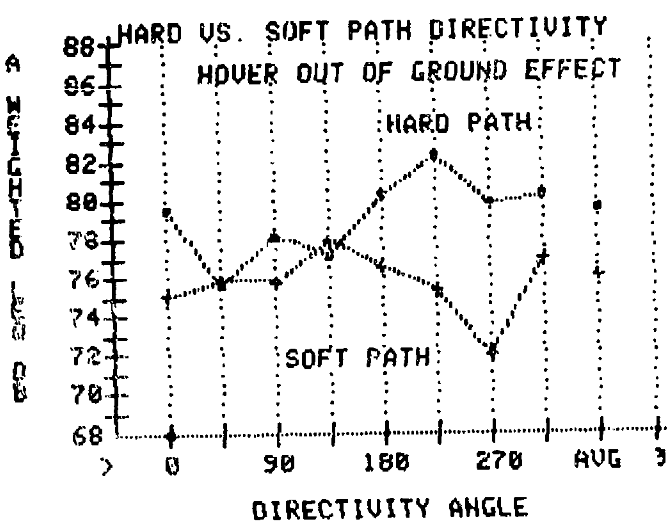


Figure 9.7

Discussion: Flight Idle (FI) - The flight idle operations, shown in Figure 9.8, are of little potential environmental concern (at a distance of 500 feet) over a soft propagation path. Again, the hard path scenario could pose minor concern in certain urban residential situations.

Discussion: Ground Idle (GI) - The ground idle operation, shown in Figure ~.9, (of limited duration) should cause very little environmental problem at a distance of 500 feet in an urban environment, especially over soft propagation paths. Part of an effective "Fly Neighborly" program is the practice of reducing rotor RPM from FI conditions to GI conditions as quickly as cooling requirements will allow. As implied above, the well-designed heliport will utilize the readily available noise benefit associated with a grassy buffer area whenever possible.

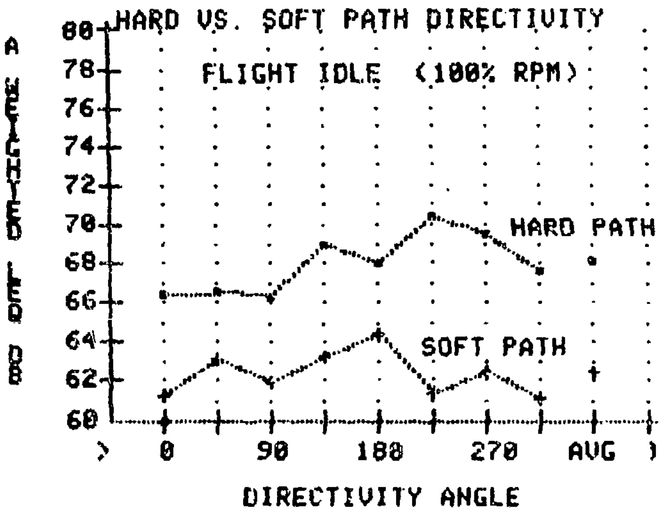


Figure 9.8

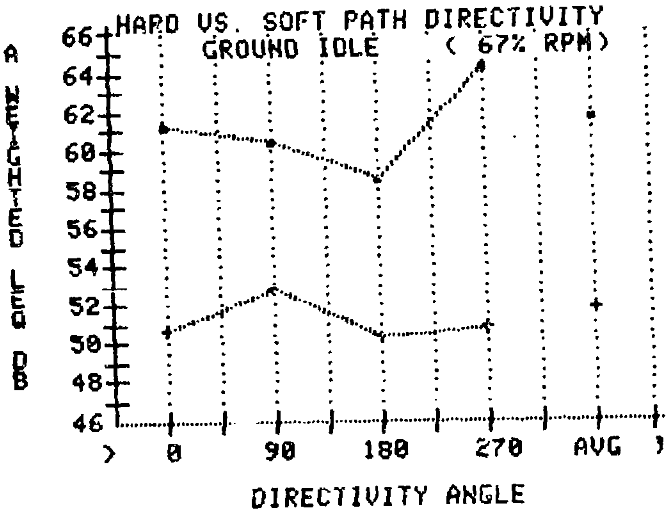


Figure 9.9

9.3 Comparison of Measured Sound Levels: 4 Foot vs. Ground Microphones - This analysis addresses the comparability of noise levels measured at different heights above the ground surface. The topic is discussed in the context of noise certification testing requirements. The analysis involves examination of differences between noise levels acquired for ground mounted and 4-ft mounted microphone systems. The objectives of this analysis are as follows: 1) to observe the value and variability of empirical ground/4-ft microphone differences and identify the degree of phase coherence, and 2) to examine the variation with operational configuration.

The data employed in this analysis are from microphone site #1, using TSC magnetic recordings. The mean differences between the ground and four foot microphones are shown in Table 9.1 for seventeen different test series.

In conducting this analysis, our initial assumption was that the ground-mounted microphone experiences phase coherent pressure doubling (a reasonable assumption at the frequencies of interest). At the 4-foot microphone, one would expect to see a lower value, somehwere within the range of 0 to 3 dB, depending on the degree of random verses coherent phase between incident and reflected sound waves. It is also possible to experience phase cancellation between the two sound paths. If cancellation occurs at dominant frequencies, then one is likely to observe noise levels at the 4-foot microphone more than 3 dB below the ground microphon values.

Discussion - It is argued that acquisition of data from ground-mounted microphones provides a cleaner spectrum, closer to the spectrum actually emitted by the helicopter--that is, not influenced by a mixture of constructive and destructive ground reflections. Theoretically, one would be interested in correcting ground-based data to levels expected at 4 feet or vice versa in order to maintain equally stringent regulatory policy. In other words, to change a certification procedure with a limit of 90 dB at a 4-ft. microphone to fit a ground-based microphone test, one theoretically would have to increase the limit 3 dB to maintain equal stringency.

Examination of the results in Table 9.1 show that, most differences do fall between Ø and 3 dB, with some differences on the order of 4 to 5 dB. These results are consistent with theory and suggest that a value of 4 or 5 dB would be appropriate for use in a regulatory revision (as discussed above). It is also interesting to note that the most pronounced differences (greater than 3 dB) occur for test series N, the 55 kt, 6-degree approach operation. Looking ahead to section 9.6, one finds this operation to be a highly impulsive flight regime for the Bell 222.

HELICOPTER: BELL 222

TABLE 9.1

COMPARISON OF

GROUND AND 4 FT. (1.2 M) MICROPHONE DATA

TEST SERIES	OPERATION	SAMPLE SIZE	TARGET IAS (KTS)	DELTA dB = (GND MIC.) minus (4 FT. MIC.) SEL	AL	EPNL	PNLTM
A	1000' LFO	6	123	2.8	2.4	2.7	2
B	500' LFO	3	137	3.2	3.3	3.1	3.6
C	500' LFO	6	123	3.3	3.4	3.1	3.4
D	500' LFO	3	110	3.4	3.5	3.2	3.7
K	500' LFO	6	65	3.2	3.6	3.2	2.5
L	ICAO T/O	6	65	3.1	3.3	2.8	2.4
M	6 DEG APP	3	45	3.7	3.3	4.9	3.4
N	6 DEG APP	4	55	5.1	5.5	4.7	4.6
O	6 DEG APP	3	75	4.7	4.5	NA	4
P	6 DEG APP	3	85	3.5	4.4	3	3.3
T	12 DEG APP	3	45	4.1	3.8	3.4	2.9
U	12 DEG APP	3	44	2.7	2	2.5	1.6
V	12 DEG APP	3	65	3.4	3.2	3	2.8
W	12 DEG APP	4	75	3.3	3.1	2.9	2.6
		WEIGHTED AVERAGE		3.5	3.5	3.2	3

9.4 Analysis of Duration Effects - This analysis explores the relationship between the helicopter noise event (intensity) time-history, the maximum intensity, and the total acoustical energy of the event. Our interests in this endeavor include the following:

1) It is often necessary to estimate an acoustical metric given only part of the information required.

2) The time history duration is related to the ground speed and altitude of a helicopter. Thus any data adjustments for different altitudes and speeds will affect duration time and consequently the SEL (energy metric). Needs to adjust data for these effects often arise in environmental impact analysis around heliports. In addition, the need to implement data corrections in helicopter noise certification tests further warrants the study of duration effects.

Two different approaches have been utilized in analyzing the effect of event 10-dB-down duration on the accumulated energy dose (Sound Exposure Level).

Both techniques are empirical, each employing the same input data but using a different theoretical approach to describe duration influences.

The fundamental question one may ask is "If we know the maximum A-weighted sound level and we know the 10-dB-down duration time, can we with confidence estimate the acoustical energy dose, the Sound Exposure Level?" A rephrasing of this question might be: If we know the SEL, the AL, and the 10-dB-down duration time (DURATION), can we construct a universal relationship linking all three?

both attempts to establish relationships involve taking the difference between the SEL and AL (delta), placing the delta on the left side of the equation and solving as a function of duration. The form which this function takes represents the differences in approach.

In the first case, one assumes that delta equals some constant K(DUR) multiplied by the base 10 logarithm of DURATION, i.e.,

$$SEL - AL = K(DUR) \times LOG(DURATION)$$

In the second case, we retain the 10 x LOG dependency, consistent with theory, while achieving the equality through the shape factor, Q, which is some value less than unity i.e., SEL-AL = 10 x LOG(Q X DURATION). In a situation where the flyover noise event time history was represented by a step function or square wave shape, we would expect to see a value of Q equaling precisely one. However, we know that the time history for typical non-impulsive event is much closer in shape to an isoceles triangle and consequently likely to have a Q much closer to 0.5

Through investigating the characteristics of the shape factor, that is, the variation in Q with ground speed and distance (i.e., Duration) one may be able to derive the expression for the aggregate acoustical radiation pattern such as dipole ($\pi/2$), quadrupole ($\pi/4$), or monopole. This can be determined by solving the relationship between Q and the ratio (π/J), where J is the value which determines the radiation pattern.

Another possible use of this analytical approach for the assessment of duration effects is in correcting noise certification test data which were acquired under conditions of nonstandard ground speed and/or distance.

Discussion - Each of the noise template data tables lists both of the duration related figures of merit for each individual event (see Appendix C). One immediate observation is the apparent insensitivity of the metrics to changes in operation, and the relatively small variation in the range of metric values, 0.4 to 0.6 in the case of Q, and 6.0 to 8.0 in the case of K(A). Plots have been provided in Figures 9.10, 9.11, and 9.12 which show the variation of both metrics with airspeed for several different operational configurations for the microphone site 1 direct read system. The lack of variation in the parameters suggests that a simple and nearly constant dependency exists between SEL, AL, and log DURATION, relatively unaffected by changes in airspeed, in turn suggesting a consistent time history shape for the range of airspeed evaluated in this test. As SEL increases with airspeed, the increase appears to be related to increase in AL_M but mitigated in part by reduced duration time (and a nearly constant K=7).

Another interesting question to ponder is whether or not other helicopter models will have unique values for K and Q different from those for the Bell 222. The implication is that it may be appropriate to develop unique constants for different helicopter models for use in implementing duration corrections.

As mentioned above, it is possible to establish an empirical aggregate acoustical radiation pattern by examining the relationship between Q and the ratio π/J where J reflects the geometric nature of the radiation pattern. The term empirical aggregate is used in acknowledging the multi-component characteristics of acoustical radiation from rotating airfoils. While the constant J may be of limited use in detailed, first-principal predictive acoustics, there may be uses in many

semi-empirical engineering applications. As is evident, the value of J ($J = \pi/Q$) determined from this empirical analysis falls between approximately 6 and 8.

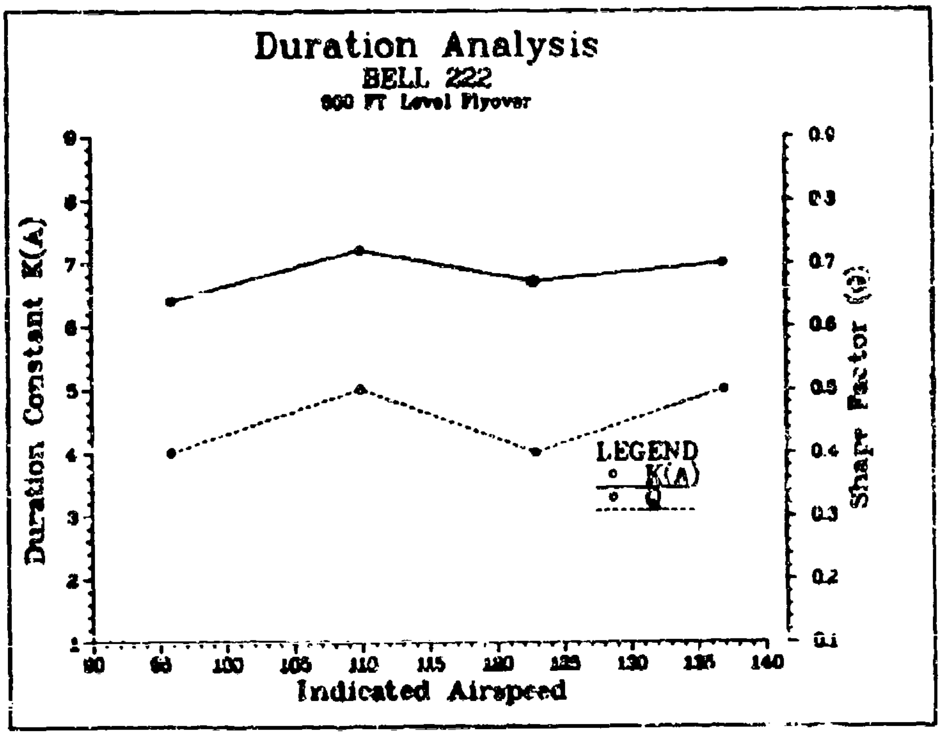


Figure 9.10

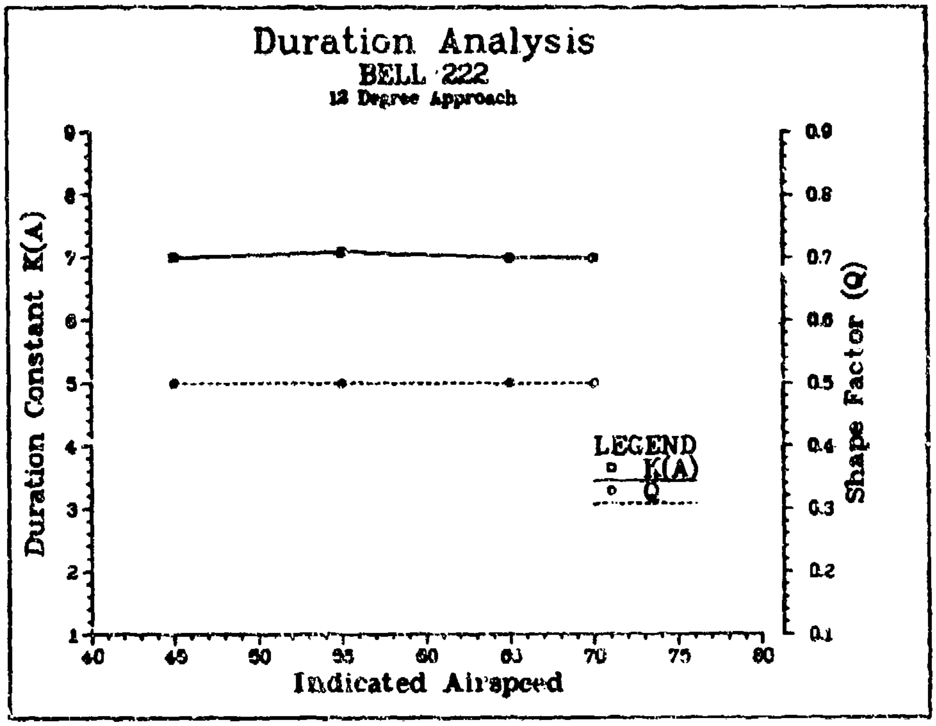


Figure 9.11

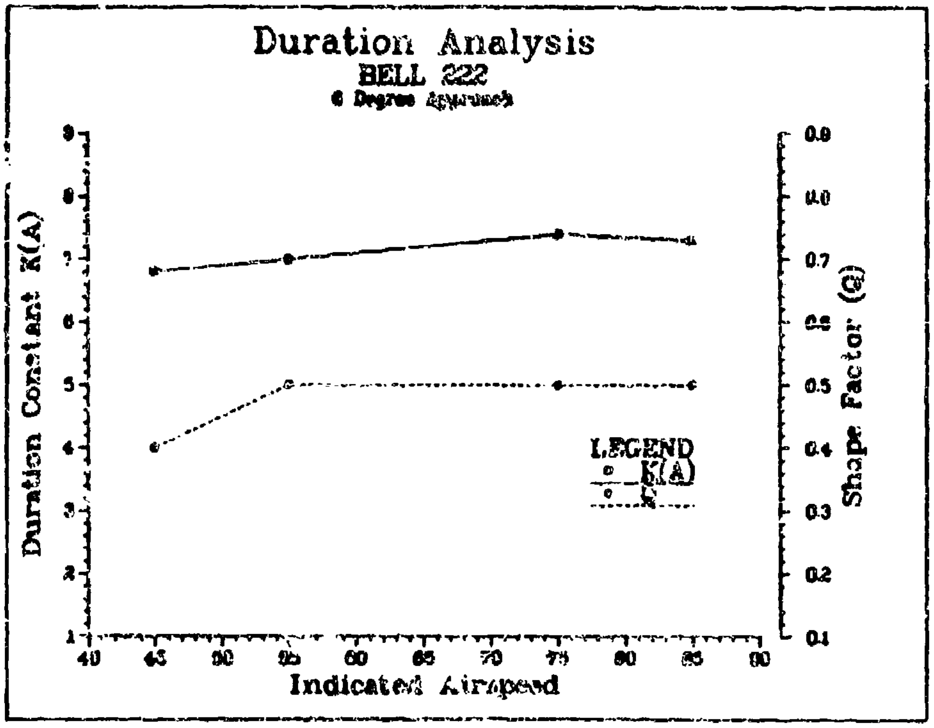


Figure 9.12

9.5 Analysis of Variability in Noise Levels for Two Sites Over Similiar Propagation Paths - This analysis examines the differences in noise levels observed for two sites each located 500 feet away from the hover point over similar terrain. The objective of the analysis was to examine variability in noise levels associated with ground-to-ground propagation over nominally similar propagation paths. The key word in the last sentence was nominally,...in fact the only difference in the propagation paths is that microphone 1F is located in a slight depression, (elevation is minus 2.5 feet relative to the hover point), while site 2 has an elevation of plus 0.2 feet relative to the hover point. This is a net difference of 2.7 feet over a distance of 500 feet. This configuration serves to demonstrate the sensitivity of ground-to-ground sound propagation on minor terrain variations.

Discussion - The results presented in Table 9.2, 9.3, and 9.4 show the observed differences in time average noise levels for eight directivity angles and the spacial average. It is observed that a difference in noise level occurs (on the order of 3 dB) for the low angle (ground-to-ground propagation scenarios) while the higher angle operation (HOGE - helicopter 30 feet above ground level) reveals a difference of only 1 dB. It may be concluded that very minor variations in site elevation may lead to differences in the measured noise levels for static operations. While these differences are insignificant in a community noise impact analysis, they would be important in aircraft noise certification.

It is also appropriate to acknowledge possible variation in the acoustical source characteristics. In this analysis, data from microphone site 2 are compared with data recorded at site 1H approximately one minute later. That is the helicopter rotated 45 degrees every sixty seconds, in order to project each directivity angle; there is a 45 degree separation

between the two sites. In addition to source variation, it is also possible that the helicopter "aim," based on magnetic compass readings may have been slightly different in each case, resulting in the projection of different intensities and accounting for the observed differences. A final item of consideration is the possibility of shadowing and refraction, discussed in following sections. Regardless of what the mechanisms are which create this variance, one can agree that static operations are prone to many phenomena and often display sound levels highly variant in both direction and time.

TABLE 9.2

COMPARISON OF
NOISE VERSUS DIRECTIVITY ANGLES
FOR
TWO SOFT SURFACES

HELICOPTER: BELL 222

OPERATION: HOVER-IN-GROUND EFFECT

	DIRECTIVITY ANGLES (DEGREES)								Lav(360 DEGREE)	
SITE	0	45	90	135	180	225	270	315	ENERGY	ARITH.
	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ
SOFT 1H	61.6	62.2	62	64.7	62.6	63.3	61.8	64.2	62.9	62.8
SOFT 2	64.5	64.1	66.6	66.2	66.3	66.2	64.1	69	66.2	65.9
DELTA dB	-2.9	-1.9	-4.6	-1.5	-3.7	-2.9	-2.3	-4.8	-3.3	-3.1

* DELTA dB = (SITE 1H) minus (SITE 2)

TABLE 9.3

COMPARISON OF
NOISE VERSUS DIRECTIVITY ANGLES
FOR
TWO SOFT SURFACES

HELICOPTER: BELL 222

OPERATION: HOVER-OUT-OF-GROUND EFFECT

SITE	DIRECTIVITY ANGLES (DEGREES)								Lav(360 DEGREE)	
	0	45	90	135	180	225	270	315	ENERGY	ARITH.
	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ
SOFT 1H	73.4	78.4	73.8	77.4	77.4	76.6	77.4	79.9	77.2	76.8
SOFT 2	75.1	75.9	75.8	77.9	76.5	75.4	71.9	77	76	75.7
DELTA dB	-1.7	2.5	-2	-.5	.9	1.2	5.5	2.9	1.2	1.1

* DELTA dB = (SITE 1H) minus (SITE 2)

TABLE 9.4

COMPARISON OF
NOISE VERSUS DIRECTIVITY ANGLES
FOR
TWO SOFT SURFACES

HELICOPTER: BELL 222

OPERATION: FLIGHT IDLE

SITE	DIRECTIVITY ANGLES (DEGREES)								Lav(360 DEGREE)	
	0	45	90	135	180	225	270	315	ENERGY	ARITH.
	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ	LEQ
SOFT 1H	NA	60.6	59.4	58.7	62.4	58.4	59	58	59.8	59.5
SOFT 2	61.2	63.1	61.9	63.2	64.4	61.4	62.4	61.1	62.5	62.3
DELTA dB	NA	-2.5	-2.5	-4.5	-2	-3	-3.4	-3.1	-2.7	-2.8

* DELTA dB = (SITE 1H) minus (SITE 2)

9.6 Variation in Noise Levels With Airspeed for 6 and 12 Degree Approach Operations - This section contains an analysis of the variation in noise level as airspeed varies for 6 and 12 degree approach angles. The appropriate "As Measured" acoustical data contained in Appendix A, have been plotted (uncorrected for the minor differences in altitude) in Figure 9.13 through 9.16. The objective in conducting this analysis is twofold: first, to evaluate further the realm of "Fly Neighborly" operating possibilities, and second, to consider whether or not it is reasonable to establish a range of approach operating conditions as allowable in a noise certification test.

Discussion - In the approach operational mode, impulsive (banging or slapping) acoustical signatures are a result of the interaction between vortices (generated by the fundamental rotor blade action) colliding with successive sweeps of the rotor blades. As reported in reference 5, maximum interaction occurs at airspeeds in the 50 to 70 knot range, for rates-of-descent ranging from 200 to 400 feet per minute. When the rotor blade enters the vortex region, it experiences local pressure fluctuations and associated changes in blade loading. These perturbations and resulting pressure gradients generate the characteristic impulsive signature

The data plotted in Figure 9.13 through 9.16 demonstrate the noise/airspeed/approach angle relationship for the Bell 222 helicopter. Apparently, certain operational configurations create significantly more noise than others. It is anticipated that each individual helicopter will exhibit its own special characteristics, but generally will remain within the range of parameters discussed above.

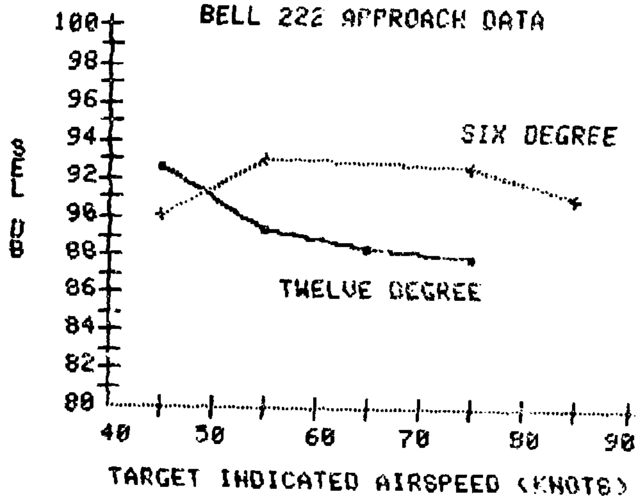


Figure 9.13

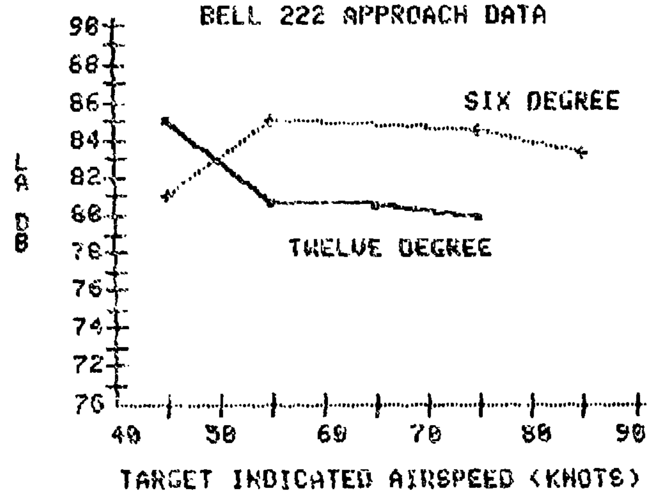


Figure 9.14

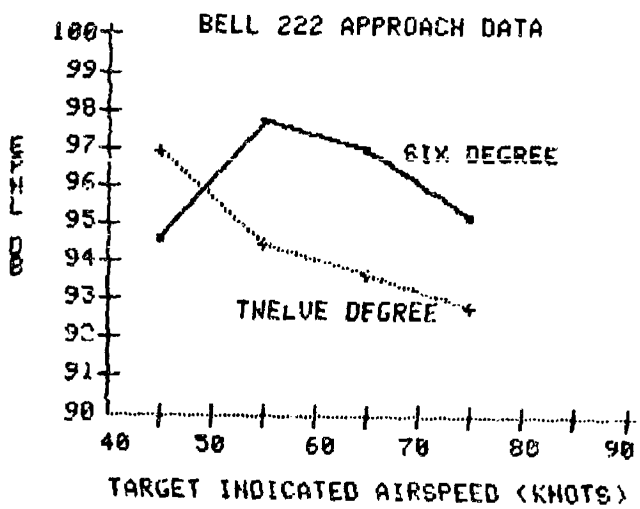


Figure 9.15

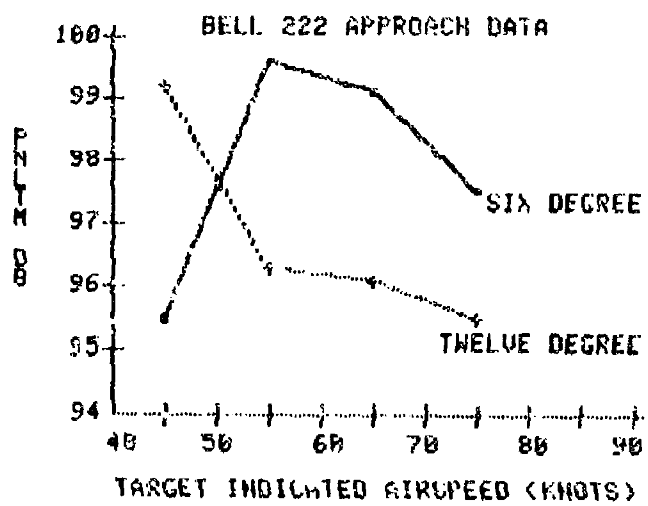


Figure 9.16

9.7 Variation in Noise Levels for Multi-Segment Approaches - This section presents a tabular summary of noise levels and operational parameters for the various experimental multi-segment approach operations conducted during the test program.

The data used in this analysis are from the centerline-center location (Mic. 1), four-foot microphone, FAA direct read system (see Appendix C). The analysis involved examination of A-weighted metrics only. In order to provide a direct comparison of noise levels for different operations, it was necessary to normalize noise data to a reference altitude, taken as the mean altitude (250 feet) for the eighteen events examined. A correction factor was also applied to the ten-dB down duration-time values as a further step in the normalization process.

The following equations were used to compute distance normalized noise levels, SEL (Sound Exposure Level) and AL_M (Maximum A-weighted Noise Level) respectively presented in Table 9.5.

$$SEL_{\frac{Dist}{Norm}} = SEL_{am} + K_S * Log\left(\frac{ALT_{Test}}{ALT_{Ref}}\right)$$

$$ALM_{\frac{Dist}{Norm}} = ALM_{am} + K_A * Log\left(\frac{ALT_{Test}}{ALT_{Ref}}\right)$$

where ALT_{Ref} is the average altitude for test series Q, which is approximately 250 feet. The propagation constants K_S and K_A have been determined empirically in previous measurement programs to be in the range of 13 to 20 and 20 to 27, respectively, for SEL and ALM. For this analysis K_S and K_A were chosen to be 16 and 23.

Normalizing the 10-dB-down time history for each event (for distance), required a pre-analysis to determine the relationship that exists between the 10-dB-down time history and altitude, for a given range of airspeeds. A regression analysis was performed for constant speed approaches at 6° and 12° approach angles.

It was found that the 10-dB-down time history (duration) can be related to distance (altitude) for the test data examined by the following equation:

$$T(10\ \text{dB}) = K_T(\text{Dist})$$

where K_T represents the slope of the regression line through the test data.

This analysis was performed for a target indicated airspeed range of 40-80 kts and resulted in an average $K_T = 0.36$.

Having determined the proportionality constant, the T(10 dB) or 10-dB-down time history of each event was normalized for distance by the following equation.

$$T(10\ \text{dB})_{\frac{\text{Dist}}{\text{Norm}}} = T(10\ \text{dB})_{AM} + K_T(ALT_{Ref} - ALT_{Test})$$

Table 9.5 shows the results of test series Q having being normalized for distance. The set of operating parameters are displayed to provide the quietest approach by ranking the series by SEL and dBA, where a rank of 1 corresponds to the quietest operating regime.

Discussion - Table 9.5 presents a summary of noise level and operational data, rank ordered from quietest to loudest (based on the SEL metric). It is interesting to note that noise levels span a range of 5 dB, exhibiting a significant potential for reducing environmental noise impact.

The interpretation of these data requires some caution, as the operational parameters are only coarsely defined (i.e., average descent angles, and instantaneous photo-readings of the instrument panel). While a truly definitive test would require continuous monitoring of the helicopter operational parameters, these results do provide a dramatic demonstration of the potential benefit associated with "Fly Neighborly" operations.

TABLE 9.5

MULTI-SEGMENT APPROACH
ANALYSIS

EVENT	SEL RANK #	DBA RANK#	DIST. NORM SEL	DIST. NORM DBA	T(10-DB) (SEC)	K(A)	IAS* (KTS)	TORQUE* (%)	ANGLE 5-1	ANGLE 1-4
032	1	1	88.3	80.21	15.26	6.8	45	35	19.5	12.4
030	2	2	88.68	81.03	11.65	6.9	48	25	11	15.4
029	3	11	89.31	82.81	9.32	6.6	80	10	8.2	4.9
026	4	7	89.56	82.08	10.49	7.2	72	10	10.1	8.2
041	5	5	89.65	81.53	13.12	7.3	60	10	19.8	7.9
031	6	4	89.71	81.48	15.13	7.2	45	10	20.2	6.2
035	7	6	90.17	81.93	12.51	7.5	70	5	12.6	6.7
027	8	12	90.23	83	10.94	6.9	60	10	12.5	10.4
033	9	3	90.28	81.27	13.69	8.1	68	5	16.6	5.4
040	10	8	90.39	82.17	14.47	7.1	60	10	19.4	12
038	11	13	90.61	83.1	10.61	7.3	70	0	12.8	8.7
036	12	10	90.64	82.43	13.08	7.5	65	0	12.2	6.7
034	13	9	90.78	82.31	13.63	7.6	60	5	17.8	6
039	14	14	91.06	83.36	11.3	7.3	55	10	14.6	5.9
028	15	15	91.85	84.27	12.59	7.1	58	10	17.3	10.9
037	16	16	92.14	84.54	11.64	7.3	55	15	16.4	7.2
025	17	17	92.61	85.75	10.87	6.6	79	25	8.7	6.3
024	18	18	93.17	85.29	11.48	7.2	64	30	6.1	4.6

*THESE VALUES ARE INSTANTANEOUS VALUES TAKEN FROM COCKPIT PHOTOS (SEE APPENDIX F).

9.8 Analysis of Ground-to-Ground Acoustical Propagation for a Nominally Soft Propagation Path - This analysis involves the empirical derivation of propagation constants for a nominally level, "soft" path, a ground surface composed of mixed grasses. As discussed in previous analyses, the several physical phenomena involved in the diminution of sound over distance makes it necessary to draw upon all pertinent theory to explain the various results obtained.

A-weighted Leq data for the four static operational modes HIGE, HOGE, Flight Idle, and Ground Idle have been analyzed in each case for eight different directivity angles. Data from sites 2 and 4H have been used to calculate the propagation constants (K) as follows:

$$K = (Leq(site) - Leq(site\ 4))/Log\ (2/1)$$

where the Log (2/1) factor represents the doubling of distance dependency (Site 2 is 492 feet and site 4H is 984 feet from the hover point).

For each mode of operation, the average (over various directivity angles) propagation constant has also been computed.

The data used in this analysis (derived from Appendix D) are displayed in Table 9.6 and the results are summarized in Table 9.7.

At first glance the results may appear somewhat distressing and inconsistent. However, upon consideration of the change in spectral content between different operational scenarios, one may approach a degree of understanding. The following paragraphs attempt to interpret the trends we observe.

Discussion -

HIGE - In the case of HIGE, one observes the aggregate influence of spreading loss, along with the lumped effects of "ground-to-ground attenuation." The potential exists for refraction effects as well, which might result in shadowing or focusing of sound. In the case of HIGE, there appears to be a high rate of attenuation which reflects a grouping of these effects.

HOGE - In the case of HOGE, several changes take place. First, the helicopter is at an altitude of approximately 30 feet above ground level, resulting in less tendency for excess ground attenuation. Secondly, the frequency spectra shift toward a greater dominance of low frequency components. It is seen that the rate of attenuation, described by the propagation constant, is much less than in the case of HIGE operations in a ground-to-ground propagation mode.

Flight Idle - In the case of the flight idle operation, one observes a rate of attenuation somewhat higher than in the case of ground idle. It can be speculated that as the frequency content becomes richer in low frequency components the effects of refraction are diminished. The average K, 22.3 for this operation, falls in the range one might expect for the presence of spherical spreading and atmospheric absorption. Again, it remains a matter of speculation to decide what particular effects are dominant in this scenario.

The mercurial nature of ground-to-ground propagation of helicopter noise is very evident from examination of the results presented and discussed

above. The primary information value of these results can perhaps be summarized as follows:

1. The rate of diminution in sound will vary with operational mode.
2. The influence of temperature inversions, typically encountered early on summer mornings, is significant on surface propagation of sound (giving rise to strong refraction effects).

   An axiom to this observation is the need to avoid early morning noise assessment/flight testing of helicopters in the static operational modes.
3. While the issue of selecting a representative ground-to-ground attenuation value to use in conducting environmental noise impact analyses remains unresolved, considerable research in this area continues.

TABLE 9.6

DATA UTILIZED IN COMPUTING EMPIRICAL PROPAGATION CONSTANTS (K)

BELL 222

6-14-83

SITE 4H--HOVER DATA

HIGE		HOGE		FLT. IDLE		GND. IDLE	
Y-0	71.1	Z-0	73.8	X-0A	69.3	X-0B	55.5
Y-315	72.2	Z-315	74.3	X-315A	67.9	X-270B	55.5
Y-270	71.3	Z-270	71.1	X-270A	68.2	X-180B	55.1
Y-225	73.7	Z-225	73.4	X-225A	68.6	X-90B	58.5
Y-180	71.8	Z-180	75.3	X-180A	70.6		
Y-135	72.3	Z-135	75.7	X-135A	69.1		
Y-90	71.8	Z-90	73.8	X-90A	68.5		
Y-45	70	Z-45	72.8	X-45A	69.3		

BELL 222

6-14-83

SITE 2--HOVER DATA

HIGE		HOGE		FLT. IDLE		GND. IDLE	
Y-0	81.7	Z-0	76	X-0A	61.5	X-0B	50.9
Y-315	86.3	Z-315	78	X-315A	61.1	X-270B	52.3
Y-270	82.8	Z-270	71.6	X-180A	62.4	X-180B	50.8
Y-225	85	Z-225	75.7	X-135A	64	X-90B	53.9
Y-180	84.2	Z-180	76.7	X-90A	62.4		
Y-135A	84.8	Z-135	77.9	X-45A	63.4		
Y-90A	85.4	Z-90	75.9				
Y-45	83	Z-45	76.3				

TABLE 9.7

EMPIRICAL PROPAGATION CONSTANTS (K)

Emission Angle	K HIGE	K HOGE	K FLT IDLE	K GND IDLE
0°	35.3	7.3	26.0	15.3
315°	47.0	12.3	22.7	
270°	38.3	1.7		10.7
225°	37.7	7.7		
180°	41.3	4.7	28.0	14.3
135°	41.7	7.3	17.0	
90°	45.3	7.0	20.3	15.3
45°	43.3	11.7	19.7	
AVERAGE	41.2	9.1	22.3	13.9

9.9 Acoustical Propagation Analysis/Discussion of Variability - The approach and takeoff operations provided the opportunity to assess empirically the influences of spherical spreading and atmospheric absorption. Through utilization of both noise and position data at each of the three flight track centerline locations (microphones 5, 1, and 4), it was possible to determine air-to-ground propagation constants.

The propagation constants (one would expect) would reflect the aggregate influences of spherical spreading and atmospheric absorption. It is assumed that the acoustical source characteristics remain constant as the helicopter passes over the measurement array. In the case of a 60-knot approach or takeoff, a helicopter would require approximately 10 seconds to travel the distance between measurements sites 4 and 5.

In both the case of the single event intensity metric, AL, and the single event energy metric, SEL, the difference between SEL and AL is determined for each pair of centerline sites. The delta in each case is then equated with the base ten logarithm of the respective altitude ratio multiplied by the propagation constant (either KP(AL) or KP(SEL), the values to be determined.

Discussion - The results of this analysis, shown in Table 9.8, are consistent only in their inconsistency, that is to say ...the values one observes for KP(AL) vary over a range which clearly demonstrates that the initial assumption of the analysis is invalid.

While this analysis fails to provide insight into nominal propagation characteristics of the atmosphere, it does succeed in identifying an interesting phenomenon: the time variant nature of helicopter noise for a nominally steady flight configuration. In order to examine this apparent anomaly, level flyover data have been examined for the three centerline

microphone locations. (See Table 9.9) The standard deviation (AL_M) has been computed for individual events across the three centerline sites. The average standard deviation has been determined for each test series.

It can be seen that the site-to-site variation in noise levels for the level flyover mode of operation is very small, averaging less than 0.5 dB. At this point it appears that the variation observed in the approach operational mode may be characteristic of that mode of flight. In order to assess further this possibility, an analysis was undertaken to determine propagation constants for approach data acquired in a 1980 FAA test (Ref. 7). This analysis, shown in Table 9.10, again reveals wide variation in computed propagation constants for the approach operation. It can be concluded that the extreme sensitivity of the approach operation to micro-meteorological effects and pilot technique makes it difficult to assume "constant source characteristics" (necessary for the highly sensitive propagation analysis) for an entire data run. However, from the standpoint of noise certification, which requires a sample of six events, the observed variation in noise levels (typically less than 1.5 dB) is not considered excessive.

TABLE 9.8
PROPAGATION CONSTANT ANALYSIS

6 Degree Approach/Target IAS = 65 kts

EVENT NO.	K (AL_M)
L1	14.8
L2	11.6
L3	12.7
L4	17.1
L5	12.8
L6	10.6
	Avg = 13.3
	σ = 2.3

6 Degree Approach/Target IAS = 45 kts

EVENT NO.	K (AL_M)
M7	-26.4
M8	25.2
M9	-3.8
	Avg = -1.67
	σ = 25.87

6 Degree Approach/Target IAS = 55 kts

EVENT NO.	K (AL_M)
N10	30.6
N11	21.3
N12	6.1
N13	10.2
	Avg = 17.1
	σ = 11.08

6 Degree Approach/Target IAS = 75 kts

EVENT NO.	K (AL_M)
O14	13.0
O15	6.5
O16	15.7
	Avg = 11.7
	σ = 4.73

12 Degree Approach/Target IAS = 45 kts

EVENT NO.	K (AL_M)
T27	25.5
T28	25.2
T29	15.5
	Avg = 22.1
	σ = 5.69

12 Degree Approach/Target IAS = 55 kts

EVENT NO.	K (AL_M)
U30	28
U31	14.2
U32	22.6
	Avg = 21.6
	σ = 6.95

12 Degree Approach/Target IAS = 65 kts

EVENT NO.	K (AL_M)
V33	18.9
V34	17.5
V35	18.3
	Avg = 18.2
	σ = .70

12 Degree Approach/Target IAS = 75 kts

EVENT NO.	K (AL_M)
W36	20.2
W37	17.6
W38	20
W39	NA
W40	19.9
	Avg = 19.4
	σ = 1.22

TABLE 9.9

SITE-TO-SITE VARIATION IN LEVEL FLYOVER NOISE LEVELS

EVENT NO.	L_{AM} 150M EAST MIC	L_{AM} CENTERLINE CENTER MIC	L_{AM} 150M WEST MIC	3 MIC AVG	3 MIC STD DEV
		500 FT IAS = 137 kts			
B7	79.3	79.3	79.0	79.2	.17
B8	81.9	82.0	81.0	81.6	.55
B9	81.4	81.5	81.4	81.4	.06
					AVG = 0.26
		500 FT IAS = 123 kts			
C10	80.1	79.8	80.2	80.0	.21
C11	79.2	79.7	78.9	79.3	.40
C12	79.6	79.9	79.9	79.8	.17
C13	81.4	81.2	80.8	81.1	.31
C14	79.7	79.6	79.4	79.6	.15
C15	79.0	79.0	78.6	78.9	.23
					AVG = 0.25
		500 FT IAS = 110 kts			
D16	78.1	78.9	78.1	78.4	.46
D17	78.4	78.6	77.6	78.2	.53
D18	78.6	78.5	77.5	78.2	.61
					AVG = 0.53
		1000' FT IAS = 123 kts			
A1	72.2	72.7	71.7	72.2	.50
A2	71.1	70.8	70.5	70.8	.30
A3	71.1	71.5	71.0	71.2	.26
A4	70.7	71.4	70.0	70.7	.70
A5	72.1	71.0	70.0	71.0	1.05
A6	73.2	72.6	72.7	72.8	.32
					AVG = .52

TABLE 9.10

PROPAGATION CONSTANT ANALYSIS FOR APPROACH OPERATION

(DATA FROM REFERENCE 6)

UH60A Site 2-3

EVENT NO.	K	
16	9.2	
17	8.3	
18	23.3	
19	23.3	
20	30.0	
21	30.8	
22	23.3	
23	26.7	
24	25.0	
	AVG = 22.2	
	= 8.1	

S76 100% Main Rotor RPM

EVENT NO.	K	
34	38.3	
36	54.2	
40	25.0	
42	33.3	
44	NA	No Tracking Data
54	32.5	
56	40.0	
	AVG = 37.2	
	= 9.8	

A-109

EVENT NO.	K
24	36.7
26	14.2
28	39.2
32	38.3
34	35.0
36	17.5
38	25.8
40	40.8
	AVG = 30.9
	= 10.4

REFERENCES

1. "Determination of Minimum Distance from Ground Observor to Aircraft For Acoustic Tests," Aerospace Information Report 902, Society of Automotive Engineers, May 15, 1966.

2. Richner, Hans and Peter Phillips, "Reproducibility of VIZ Radiosonde Data and Some Sources of Air," Journal of Applied Meteorology, 26, November 1980, May 1981.

3. "Noise Standards: Aircraft Type and Airworthiness Certification," Federal Aviation Regulations Part 36, Department of Transportation, Washington, D.C., June 1974.

4. FAR 36, Appendix B, Section B36.2.3.3.

5. "International Standards and Recommended Practices - Aircraft Noise," Annex 16, International Civil Aviation Organization, May 1981, Appendix 4, paragraph 4.3.

6. Westland Helicopters Limited, via P. R. Kearsey, personal communication, January 1984.

7. Cox, C. R., "Helicopter Rotor Aerodynamic and Aeroacoustic Environments," paper at the 4th AIAA Aeroacoustic Conference, Atlanta, GA, October 1977.

APPENDIX A

Magnetic Recording Acoustical Data and Duration Factors for Flight Operations on June 14 and 15

This appendix contains magnetic recording acoustical data acquired during flight operations on June 14, and 15, 1983. A detailed discussion is provided in section which describes the data reduction and processing procedures. Helpful cross reference include, measurement location layout, Figure 3.3; measurement equipment schematic, Figure 5.4; and measurement deployment plan, Figure 5.7. The magnetic recording data for June 16 are contained in Appendix B. Tables A.a and A.b which follow below provide the reader with a guide to the structure of the appendix and the definition of terms used herein.

TABLE A.a

The key to the table numbering system is as follows:

Table No. A. 1-1. 1

Appendix No.______

Helicopter No. & Microphone Location__________

Page No. of Group____

Table No. A.5-X.X, where the number 5 represents the Bell 222 helicopter.

Microphone No.		
	1	centerline-center
	1G	centerline-center(flush)
	2	sideline 492 feet (150m) south
	3	sideline 492 feet (150m) north
	4	centerline 492 feet (150m) west
	5	centerline feet (188m) east

TABLE A.b

Definitions

A brief synopsis of Appendix A data column headings is presented.

EV	Event Number
SEL	Sound Exposure Level, the total sound energy measured within the period determined by the 10 dB down duration of the A-weighted time history. Reference duration, 1-second.
ALm	A-weighted Sound Level(maximum)
SEL-ALm	Duration Correction Factor
K(A)	A-weighted duration constant where: $K(A) = (SEL-ALm) \div (Log\ DUR(A))$
Q	Time History Shape Factor, where: $Q = (10^{0.1(SEL-ALm)} \div (DUR(A))$
EPNL	Effective Perceived Noise Level
PNLm	Perceived Noise Level(maximum)
PNLTm	Tone Corrected Perceived Noise Level(maximum)
K(P)	Constant used to obtain the Duration Correction for EPNL, where: $K(P) = (EPNL-PNLTm + 10) \div (Log\ DUR(P))$
OASPLm	Overall Sound Pressure Level(maximum)
DUR(A)	The 10 dB down Duration Time for the A-weighted time history
DUR(P)	The 10 dB down Duration Time for the PNLT time history
TC	Tone Correction calculated at PNLTm

Each set of data is headed by the site number, microphone location and test date. The target reference condtions are specified above each data subset.

TABLE NO. A.5-1.1

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/26/83

SITE: 1 CENTERLINE - CENTER JUNE 14,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
12 DEGREE APPROACH -- TARGET IAS 45KTS.													
T27	93.0	85.4	7.5	7.2	0.5	97.2	98.7	99.4	7.4	96.8	11.0	11.5	0.9
T28	91.9	85.3	6.6	4.8	0.2	96.0	98.7	99.5	6.0	97.0	23.5	12.0	1.0
T29	93.1	84.4	8.7	6.8	0.4	97.4	97.9	98.7	6.8	96.9	19.0	19.0	0.8
Avg.	92.6	85.0	7.6	6.3	0.4	96.9	98.4	99.2	6.7	96.9	17.8	14.2	0.9
Std Dv	0.7	0.5	1.0	1.3	0.2	0.7	0.5	0.5	0.7	0.1	6.3	4.2	0.1
90% CI	1.1	0.9	1.7	2.2	0.3	1.2	0.8	0.8	1.1	0.1	10.7	7.1	0.2
12 DEGREE APPROACH -- TARGET IAS 55KTS.													
U30	88.1	79.5	8.5	7.0	0.4	93.2	94.3	95.2	6.8	94.4	16.5	15.5	0.9
U31	90.1	80.0	10.1	7.9	0.5	95.1	94.6	95.4	7.8	93.4	19.0	18.0	0.8
U32	89.9	82.6	7.3	6.9	0.5	95.2	97.4	98.3	6.6	96.1	11.5	11.0	1.0
Avg.	89.4	80.7	8.6	7.3	0.5	94.5	95.4	96.3	7.0	94.6	15.7	14.8	0.9
Std Dv	1.1	1.7	1.4	0.5	0.1	1.1	1.7	1.8	0.6	1.3	3.8	3.5	0.1
90% CI	1.9	2.8	2.4	0.9	0.1	1.8	2.9	3.0	1.1	2.3	6.4	6.0	0.2
12 DEGREE APPROACH -- TARGET IAS 65KTS.													
V33	88.2	80.2	8.0	7.6	0.6	93.3	95.1	95.8	7.3	94.7	11.5	10.5	0.7
V34	88.0	79.9	8.1	7.3	0.5	93.4	94.7	95.5	7.3	94.2	13.0	12.0	0.8
V35	89.1	81.4	7.7	7.0	0.5	94.3	96.1	97.0	6.9	95.1	13.0	11.5	0.8
Avg.	88.4	80.5	8.0	7.3	0.5	93.7	95.3	96.1	7.2	94.7	12.5	11.3	0.8
Std Dv	0.6	0.8	0.2	0.3	0.0	0.6	0.7	0.8	0.2	0.4	0.9	0.8	0.1
90% CI	1.0	1.3	0.3	0.5	0.1	0.9	1.2	1.3	0.4	0.7	1.5	1.3	0.1
12 DEGREE APPROACH -- TARGET IAS 75KTS.													
W36	87.9	79.6	8.3	7.2	0.5	92.6	94.1	95.1	7.0	94.0	14.5	12.0	0.9
W37	88.2	80.5	7.7	7.2	0.5	93.4	95.4	96.3	6.9	94.4	11.5	10.5	1.0
W38	88.0	80.0	7.9	7.3	0.5	93.1	94.7	96.0	6.9	94.9	12.0	10.5	1.3
W40	87.7	79.6	8.1	7.0	0.4	92.3	93.9	94.6	6.8	94.2	14.5	13.5	0.8
Avg.	87.9	79.9	8.0	7.2	0.5	92.8	94.5	95.5	6.9	94.4	13.1	11.6	1.0
Std Dv	0.2	0.4	0.3	0.2	0.0	0.5	0.7	0.8	0.1	0.4	1.6	1.4	0.2
90% CI	0.2	0.5	0.3	0.2	0.0	0.5	0.8	0.9	0.1	0.5	1.9	1.7	0.2

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-1.2

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/26/83

SITE: 1 CENTERLINE - CENTER JUNE 14,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(F)	TC
6 DEGREE APPROACH -- TARGET IAS 45KTS.													
M7	91.8	84.2	7.6	6.3	0.4	96.3	97.1	98.2	6.6	95.1	16.0	17.0	1.1
M8	88.4	78.9	9.5	7.0	0.4	93.0	92.8	93.5	7.0	94.5	22.5	22.5	0.7
M9	90.0	79.9	10.1	6.9	0.4	94.5	94.2	94.9	6.6	93.8	29.0	27.5	1.0
Avg.	90.1	81.0	9.1	6.8	0.4	94.6	94.7	95.5	6.7	94.4	22.5	22.3	0.9
Std Dv	1.7	2.8	1.3	0.4	0.0	1.7	2.2	2.4	0.2	0.6	6.5	5.3	0.2
90% CI	2.9	4.7	2.2	0.6	0.0	2.8	3.7	4.1	0.4	1.1	11.0	8.9	0.3
6 DEGREE APPROACH -- TARGET IAS 55KTS.													
N10	92.8	84.6	8.2	7.0	0.5	97.8	98.3	99.4	7.2	97.4	14.5	14.5	1.1
N11	92.0	83.4	8.7	7.4	0.5	96.2	96.6	97.7	7.2	95.6	15.0	15.0	1.0
N12	94.0	87.2	6.8	6.1	0.4	98.6	100.1	101.0	6.7	97.5	13.0	13.5	0.9
N13	93.3	84.7	8.6	7.2	0.5	98.2	97.7	100.1	7.0	97.5	15.5	14.5	2.4
Avg.	93.0	85.0	8.1	6.9	0.4	97.7	98.2	99.6	7.0	97.0	14.5	14.4	1.4
Std Dv	0.8	1.6	0.9	0.6	0.1	1.1	1.4	1.4	0.2	1.0	1.1	0.6	0.7
90% CI	1.0	1.9	1.0	0.7	0.1	1.3	1.7	1.7	0.3	1.1	1.3	0.7	0.8
6 DEGREE APPROACH -- TARGET IAS 75KTS.													
O14	93.1	84.9	8.2	7.6	0.6	97.5	98.9	99.4	7.5	98.8	12.0	12.0	0.4
O15	92.3	84.3	8.0	7.4	0.5	96.7	98.2	98.9	7.2	98.3	12.0	12.0	0.7
O16	92.5	84.4	8.1	7.0	0.4	96.8	98.4	99.1	7.3	97.1	14.5	11.5	0.7
Avg.	92.6	84.5	8.1	7.3	0.5	97.0	98.5	99.1	7.3	98.1	12.8	11.8	0.6
Std Dv	0.4	0.3	0.1	0.3	0.1	0.4	0.4	0.2	0.2	0.9	1.4	0.3	0.2
90% CI	0.7	0.6	0.2	0.5	0.1	0.7	0.6	0.3	0.3	1.5	2.4	0.5	0.3
6 DEGREE APPROACH -- TARGET IAS 85KTS.													
P17	90.6	82.5	8.1	7.4	0.5	95.0	96.8	97.6	7.0	96.4	12.5	11.5	0.8
P18	91.0	83.0	8.0	7.0	0.5	95.1	96.1	97.0	7.1	95.2	14.0	13.5	0.9
P19	91.8	84.4	7.4	6.8	0.5	95.5	96.9	97.8	7.0	96.3	12.0	12.5	0.9
Avg.	91.1	83.3	7.8	7.1	0.5	95.2	96.6	97.5	7.1	96.0	12.8	12.5	0.9
Std Dv	0.6	1.0	0.4	0.3	0.0	0.3	0.4	0.4	0.1	0.6	1.0	1.0	0.1
90% CI	1.0	1.7	0.7	0.5	0.1	0.5	0.7	0.7	0.1	1.1	1.8	1.7	0.1

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-1.3

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/26/83

SITE: 1 CENTERLINE - CENTER JUNE 14,1983

EV	SEL	ALM	SEL-ALM	K(A)	Q	EPNL	PNLM	PNLTM	K(P)	OASPLM	DUR(A)	DUR(P)	TC
6 DEGREE APPROACH -- TARGET IAS 65KTS. (ICAO)													
L1	92.8	84.2	8.6	7.5	0.5	97.2	98.3	99.1	7.2	97.1	14.0	13.0	0.9
L2	93.9	86.1	7.8	7.2	0.5	98.3	100.2	100.8	6.9	99.2	12.0	12.0	0.6
L3	94.1	86.6	7.5	7.2	0.5	98.7	100.6	101.5	6.9	99.9	11.0	11.0	0.9
L4	93.4	86.3	7.1	6.7	0.4	98.0	100.2	100.9	6.6	99.7	11.5	11.5	0.7
L5	93.7	86.2	7.5	7.3	0.5	98.1	100.3	101.1	7.1	99.5	10.5	9.5	0.8
L6	94.6	87.0	7.6	7.3	0.5	99.1	101.1	101.7	7.3	100.2	11.0	10.5	0.7
Avg.	93.7	86.1	7.7	7.2	0.5	98.2	100.1	100.9	7.0	99.3	11.7	11.2	0.8
Std Dv	0.6	1.0	0.5	0.3	0.0	0.7	1.0	0.9	0.2	1.1	1.3	1.2	0.1
90% CI	0.5	0.8	0.4	0.2	0.0	0.6	0.8	0.8	0.2	0.9	1.0	1.0	0.1
TAKEOFF -- TARGET IAS 65KTS. (ICAO)													
K20	84.6	73.8	10.8	7.9	0.5	88.5	86.8	89.2	7.3	82.9	23.0	18.5	2.4
K21	83.8	73.8	10.0	7.6	0.5	88.3	87.6	89.8	6.9	84.4	20.5	17.0	2.2
K22	83.4	72.8	10.7	7.5	0.4	87.8	86.4	88.5	6.6	83.6	27.0	25.5	2.3
K23	83.6	74.5	9.1	7.0	0.4	87.7	87.5	89.4	6.8	84.2	20.0	16.5	1.9
K24	83.9	73.5	10.5	7.6	0.5	87.9	86.6	88.8	7.1	82.6	24.0	19.0	2.2
K25	83.5	73.2	10.3	7.5	0.4	87.5	85.6	88.0	7.1	82.1	24.0	21.0	2.7
Avg.	83.8	73.6	10.2	7.5	0.5	87.9	86.8	89.0	7.0	83.3	23.1	19.6	2.3
Std Dv	0.4	0.6	0.6	0.3	0.0	0.4	0.8	0.7	0.3	0.9	2.6	3.3	0.3
90% CI	0.3	0.5	0.5	0.2	0.0	0.3	0.6	0.5	0.2	0.8	2.1	2.7	0.2

* - NOISE INDEXES CLACUALTED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-1.4

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/26/83

SITE: 1 CENTERLINE - CENTER JUNE 15,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
500 FT. FLYOVER -- TARGET IAS 137KTS.													
B7	86.5	79.3	7.2	6.9	0.5	91.1	92.5	93.7	6.8	93.4	11.0	12.5	1.4
B8	88.5	82.0	6.5	6.5	0.4	93.2	95.4	96.0	6.8	96.1	10.0	11.5	1.0
B9	88.6	81.5	7.1	6.9	0.5	93.2	95.1	96.0	6.9	96.1	10.5	11.0	0.9
Avg.	87.8	80.9	6.9	6.8	0.5	92.5	94.3	95.2	6.8	95.2	10.5	11.7	1.1
Std Dv	1.2	1.4	0.3	0.2	0.0	1.2	1.6	1.3	0.1	1.6	0.5	0.8	0.2
90% CI	2.0	2.4	0.6	0.4	0.0	2.0	2.7	2.3	0.1	2.7	0.8	1.3	0.4
500 FT. FLYOVER -- TARGET IAS 123KTS.													
C10	87.0	79.8	7.2	6.8	0.5	91.7	93.6	94.3	6.8	94.3	11.5	12.0	0.7
C11	87.0	79.7	7.2	6.6	0.4	91.6	93.7	94.3	6.4	94.2	12.5	13.5	0.6
C12	87.7	79.9	7.8	6.8	0.4	92.4	93.6	94.1	7.1	94.7	14.0	14.5	0.6
C13	87.6	81.2	6.4	6.4	0.4	92.4	95.2	95.8	6.5	95.8	10.0	10.0	1.0
C14	86.6	79.6	7.0	6.7	0.5	91.2	93.4	94.0	6.5	93.8	11.0	12.5	0.7
C15	85.7	79.0	6.7	6.5	0.4	90.3	92.7	93.3	6.5	93.3	11.0	12.0	0.6
Avg.	86.9	79.9	7.1	6.6	0.4	91.6	93.7	94.3	6.6	94.3	11.7	12.4	0.7
Std Dv	0.7	0.7	0.5	0.2	0.0	0.8	0.8	0.8	0.3	0.8	1.4	1.5	0.2
90% CI	0.6	0.6	0.4	0.2	0.0	0.6	0.7	0.7	0.2	0.7	1.2	1.3	0.1
500 FT. FLYOVER -- TARGET IAS 110KTS.													
D16	86.0	78.9	7.1	6.4	0.4	90.3	92.5	93.1	6.5	93.0	13.0	13.0	0.6
D17	85.9	78.6	7.3	6.9	0.5	90.1	92.4	93.0	6.6	92.7	11.5	12.0	0.7
D18	86.1	78.5	7.6	6.4	0.4	90.7	92.4	93.2	6.3	92.5	15.5	15.0	0.9
Avg.	86.0	78.7	7.3	6.6	0.4	90.4	92.4	93.1	6.5	92.7	13.3	13.3	0.7
Std Dv	0.1	0.2	0.3	0.3	0.0	0.3	0.1	0.1	0.1	0.2	2.0	1.5	0.1
90% CI	0.2	0.3	0.5	0.5	0.1	0.5	0.2	0.1	0.2	0.4	3.4	2.6	0.2
500 FT. FLYOVER -- TARGET IAS 96KTS.													
E19	85.2	78.7	6.5	6.1	0.4	89.9	93.2	94.1	5.8	90.6	11.5	10.0	0.9
Avg.	85.2	78.7	6.5	6.1	0.4	89.9	93.2	94.1	5.8	90.6	11.5	10.0	0.9
Std Dv	-	-	-	-	-	-	-	-	-	-	-	-	-
90% CI	-	-	-	-	-	-	-	-	-	-	-	-	-

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-1.5

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/26/83

SITE: 1 CENTERLINE - CENTER JUNE 15,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
1000 FT. FLYOVER -- TARGET IAS 123KTS.													
A1	83.0	72.7	10.3	7.6	0.5	86.9	86.2	87.2	7.4	88.1	22.0	21.0	1.0
A2	81.7	70.8	10.9	7.8	0.5	85.7	84.2	85.3	7.4	85.9	25.5	25.5	1.1
A3	81.8	71.5	10.3	7.6	0.5	85.7	84.9	85.9	7.2	86.3	23.0	23.5	1.1
A4	81.5	71.4	10.1	7.4	0.4	85.2	84.8	85.9	6.8	85.7	23.5	23.0	1.1
A5	81.5	71.0	10.6	7.4	0.4	85.4	84.6	85.5	7.0	85.9	27.0	26.0	0.9
A6	82.6	72.6	10.0	7.3	0.4	-	85.9	86.6	-	88.1	24.0	-	0.7
Avg.	82.0	71.7	10.4	7.5	0.5	85.8	85.1	86.1	7.2	86.7	24.2	23.8	1.0
Std Dv	0.6	0.8	0.3	0.2	0.0	0.7	0.8	0.7	0.2	1.1	1.8	2.0	0.2
90% CI	0.5	0.7	0.3	0.2	0.0	0.6	0.6	0.6	0.2	0.9	1.5	1.9	0.1
APPROACH -- MULTI-SEG. 1													
Q21	90.3	84.8	5.5	6.3	0.5	95.4	99.2	100.1	6.0	100.1	7.5	7.5	0.9
Avg.	90.3	84.8	5.5	6.3	0.5	95.4	99.2	100.1	6.0	100.1	7.5	7.5	0.9
Std Dv	-	-	-	-	-	-	-	-	-	-	-	-	-
90% CI	-	-	-	-	-	-	-	-	-	-	-	-	-
APPROACH -- MULTI-SEG. 2													
R22	90.3	83.4	6.9	6.9	0.5	95.8	98.6	99.4	6.7	99.1	10.0	9.0	0.8
Avg.	90.3	83.4	6.9	6.9	0.5	95.8	98.6	99.4	6.7	99.1	10.0	9.0	0.8
Std Dv	-	-	-		-	-	-	-	-	-	-	-	-
90% CI	-	-	-	-	-	-	-	-	-	-	-	-	-
APPROACH -- MULTI-SEG. 3													
S23	94.7	87.9	6.9	6.9	0.5	99.6	101.8	102.7	6.7	98.8	10.0	10.5	0.9
Avg.	94.7	87.9	6.9	6.9	0.5	99.6	101.8	102.7	6.7	98.8	10.0	10.5	0.9
Std Dv	-	-	-	-	-	-	-	-	-	-	-	-	-
90% CI	-	-	-	-	-	-	-	-	-	-	-	-	-

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-16.1

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/19/83

SITE: 16 CENTERLINE-CENTER (FLUSH) JUNE 14,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
12 DEGREE APPROACH -- TARGET IAS 45KTS.													
T27	96.8	89.3	7.5	7.3	0.5	100.6	101.9	102.6	7.5	100.0	10.5	11.5	1.0
T28	96.7	88.7	8.0	6.3	0.3	100.1	101.3	101.9	6.4	99.0	18.5	19.0	0.6
T29	96.6	88.5	8.1	6.3	0.3	100.1	101.2	101.8	6.5	99.0	19.0	19.0	0.6
Avg.	96.7	88.8	7.9	6.7	0.4	100.3	101.4	102.1	6.8	99.3	16.0	16.5	0.7
Std Dv	0.1	0.4	0.3	0.6	0.1	0.3	0.4	0.4	0.6	0.6	4.8	4.3	0.2
90% CI	0.1	0.7	0.5	1.0	0.2	0.5	0.7	0.8	1.0	1.0	8.0	7.3	0.4
12 DEGREE APPROACH -- TARGET IAS 55KTS.													
U30	91.3	82.3	9.1	7.3	0.5	96.1	96.5	97.3	7.2	96.0	17.5	17.0	0.9
U31	93.0	83.1	9.8	7.7	0.5	97.8	97.4	98.4	7.3	96.4	19.0	19.0	1.2
U32		----------		NO DATA		----------							
Avg.	92.1	82.7	9.4	7.5	0.5	97.0	96.9	97.9	7.2	96.2	18.2	18.0	1.0
Std Dv	1.2	0.6	0.5	0.3	0.0	1.1	0.7	0.7	0.1	0.3	1.1	1.4	0.2
90% CI	5.2	2.7	2.5	1.3	0.1	5.1	2.9	3.3	0.5	1.3	4.7	6.3	0.9
12 DEGREE APPROACH -- TARGET IAS 65KTS. IAS													
V33	91.3	83.2	8.1	7.5	0.5	96.3	98.1	99.1	7.1	97.9	12.0	10.5	1.0
V34	91.2	83.0	8.2	6.9	0.4	96.0	97.1	97.9	7.1	97.5	15.5	14.5	1.0
V35	92.8	84.9	8.0	7.1	0.5	97.7	99.2	99.8	7.1	99.5	13.5	13.0	0.6
Avg.	91.8	83.7	8.1	7.1	0.5	96.7	98.1	98.9	7.1	98.3	13.7	12.7	0.9
Std Dv	0.9	1.0	0.1	0.3	0.1	0.9	1.1	1.0	0.0	1.1	1.8	2.0	0.2
90% CI	1.6	1.7	0.2	0.5	0.1	1.5	1.8	1.6	0.1	1.8	3.0	3.4	0.4
12 DEGREE APPROACH -- TARGET IAS 75KTS.													
W36	91.1	82.4	8.7	7.5	0.5	95.5	96.4	97.2	7.3	97.5	14.5	13.5	0.8
W37	91.6	83.7	7.9	6.9	0.4	96.2	98.2	99.1	6.8	97.7	14.0	11.5	0.9
W38	91.3	83.5	7.7	7.0	0.5	95.9	98.1	99.2	6.5	98.2	12.5	11.0	1.1
W40	90.9	82.5	8.4	7.3	0.5	95.2	96.3	96.9	7.0	97.7	14.5	15.0	0.6
Avg.	91.2	83.0	8.2	7.2	0.5	95.7	97.2	98.1	6.9	97.8	13.9	12.7	0.9
Std Dv	0.3	0.7	0.4	0.3	0.0	0.5	1.0	1.2	0.4	0.3	0.9	1.8	0.2
90% CI	0.3	0.8	0.5	0.3	0.0	0.5	1.2	1.4	0.4	0.4	1.1	2.2	0.3

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-1G.2

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/24/83

SITE: 1G CENTERLINE-CENTER (FLUSH) JUNE 14,1983

EV	SEL	AL*	SEL-AL*	K(A)	Q	EPNL	PNL*	PNLT*	K(P)	OASPL*	DUR(A)	DUR(P)	TC
6 DEGREE APPROACH -- TARGET IAS 45KTS.													
M7	95.1	86.4	8.7	6.8	0.4	-	99.7	100.4	-	97.7	19.0	-	0.7
M8	91.6	81.8	9.9	7.7	0.5	-	96.0	96.6	-	98.1	19.0	-	0.6
M9	94.8	84.8	10.0	6.8	0.3	99.5	99.3	99.6	6.7	99.7	29.0	29.0	0.4
Avg.	93.8	84.3	9.5	7.1	0.4	99.5	98.3	98.9	6.7	98.5	22.3	29.0	0.6
Std Dv	1.9	2.3	0.7	0.5	0.1	-	2.0	2.0	-	1.0	5.8	-	0.1
90% CI	3.2	3.9	1.2	0.9	0.1	-	3.4	3.4	-	1.7	9.7	-	0.2
6 DEGREE APPROACH -- TARGET IAS 55KTS.													
N10	98.3	90.5	7.8	6.6	0.4	102.9	103.7	104.3	7.1	102.9	15.5	16.0	0.6
N11	97.5	89.3	8.2	6.8	0.4	101.5	102.8	103.4	6.6	102.0	16.5	17.0	0.6
N12	98.5	91.6	6.9	6.1	0.4	103.0	104.6	104.9	6.7	102.8	13.5	16.0	0.9
N13		----------		NO DATA		----------							
Avg.	98.1	90.5	7.7	6.5	0.4	102.4	103.7	104.2	6.8	102.6	15.2	16.3	0.7
Std Dv	0.5	1.1	0.7	0.3	0.0	0.8	0.9	0.8	0.3	0.5	1.5	0.6	0.1
90% CI	0.9	1.9	1.1	0.5	0.0	1.4	1.5	1.3	0.4	0.8	2.6	1.0	0.2
6 DEGREE APPROACH -- TARGET IAS 75KTS.													
O14		----------		NO DATA		----------							
O15	97.3	89.0	8.3	8.0	0.6	-	102.7	103.1	-	102.6	11.0	-	0.5
O16		----------		NO DATA		----------							
Avg.	97.3	89.0	8.3	8.0	0.6	-	102.7	103.1	-	102.6	11.0	-	0.5
Std Dv	-	-	-	-	-	-	-	-	-	-	-	-	-
90% CI	-	-	-	-	-	-	-	-	-	-	-	-	-
6 DEGREE APPROACH -- TARGET IAS 85KTS.													
P17	94.1	86.9	7.1	6.7	0.4	98.2	100.4	100.9	7.0	100.4	11.5	11.5	0.5
P18	94.5	87.2	7.2	6.8	0.5	98.1	99.3	100.3	7.1	99.3	11.5	12.5	1.0
P19	95.2	89.1	6.1	6.4	0.5	98.3	100.9	101.3	6.9	99.6	9.0	10.5	0.5
Avg.	94.6	87.7	6.8	6.6	0.5	98.2	100.2	100.8	7.0	99.7	10.7	11.5	0.7
Std Dv	0.6	1.2	0.6	0.2	0.0	0.1	0.8	0.5	0.1	0.6	1.4	1.0	0.3
90% CI	1.0	2.0	1.1	0.4	0.0	0.2	1.4	0.8	0.1	0.9	2.4	1.7	0.5

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-1G.3

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/22/83

SITE: 1G CENTERLINE-CENTER (FLUSH) JUNE 14,1983

6 DEGREE APPROACH -- TARGET IAS 65KTS. (ICAO)

EV	SEL	AL*	SEL-AL*	K(A)	Q	EPNL	PNL*	PNLT*	K(P)	OASPL*	DUR(A)	DUR(P)	TC
L1	95.2	86.5	8.7	7.2	0.5	99.5	100.0	101.0	7.4	99.4	16.0	14.0	1.0
L2	97.0	90.2	6.8	6.1	0.4	101.2	103.4	104.0	6.4	101.8	13.0	13.5	0.5
L3	96.7	89.4	7.3	6.8	0.4	100.9	102.8	103.3	6.9	101.8	12.0	12.5	0.5
L4	96.9	89.9	7.0	6.6	0.4	101.2	103.2	103.7	6.9	102.6	11.5	12.5	0.5
L5	97.0	89.6	7.3	7.0	0.5	101.1	102.9	103.2	7.1	102.3	11.0	12.5	0.3
L6	98.0	90.6	7.5	6.8	0.4	102.3	104.0	104.5	7.0	102.9	12.5	13.0	0.5
Avg.	96.8	89.4	7.4	6.8	0.4	101.0	102.7	103.3	7.0	101.8	12.7	13.0	0.5
Std Dv	0.9	1.4	0.7	0.4	0.0	0.9	1.4	1.2	0.3	1.2	1.8	0.6	0.3
90% CI	0.7	1.2	0.5	0.3	0.0	0.7	1.1	1.0	0.3	1.0	1.5	0.5	0.2

TAKEOFF -- TARGET IAS 65KTS. IAS (ICAO)

EV	SEL	AL*	SEL-AL*	K(A)	Q	EPNL	PNL*	PNLT*	K(P)	OASPL*	DUR(A)	DUR(P)	TC
K20	87.2	77.2	9.9	7.4	0.4	91.1	89.5	91.8	7.3	86.3	22.0	19.0	2.3
K21	87.2	77.6	9.6	7.6	0.5	91.5	89.7	91.8	7.7	87.0	18.0	18.0	2.1
K22	86.8	77.0	9.9	7.2	0.4	90.8	89.0	91.3	7.2	85.7	23.0	21.0	2.3
K23	86.8	76.6	10.1	7.4	0.4	90.9	88.8	91.2	7.3	87.1	27.0	21.5	2.5
K24	87.0	76.7	10.4	7.5	0.5	91.2	88.7	91.0	7.6	86.0	23.5	22.5	2.4
K25	86.9	77.8	9.1	7.0	0.4	90.8	89.7	91.9	7.1	85.7	19.5	18.5	2.1
Avg.	87.0	77.2	9.8	7.4	0.4	91.1	89.2	91.5	7.4	86.3	21.5	20.1	2.3
Std Dv	0.2	0.5	0.5	0.2	0.0	0.3	0.5	0.4	0.2	0.6	2.2	1.8	0.2
90% CI	0.1	0.4	0.4	0.2	0.0	0.2	0.4	0.3	0.2	0.5	1.8	1.5	0.1

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-1G.4

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/22/83

SITE: 1G CENTERLINE-CENTER (FLUSH) JUNE 15,1983

EV	SEL	AL■	SEL-AL■	K(A)	Q	EPNL	PNL■	PNLT■	K(P)	OASPL■	DUR(A)	DUR(P)	TC
500 FT. FLYOVER -- TARGET IAS 137KTS.													
B7	87.5	82.3	7.2	7.0	0.5	93.9	95.4	96.6	6.9	96.0	11.0	11.5	1.4
B8	91.8	85.3	6.5	6.8	0.5	96.5	98.7	100.3	6.4	98.9	9.0	9.0	1.8
B9	91.7	85.1	6.6	6.7	0.5	96.4	98.6	99.6	6.8	99.4	9.5	10.0	1.4
Avg.	91.0	84.2	6.8	6.8	0.5	95.6	97.6	98.8	6.7	98.1	9.8	10.2	1.5
Std Dv	1.3	1.7	0.4	0.1	0.0	1.4	1.9	2.0	0.2	1.8	1.0	1.3	0.2
90% CI	2.1	2.9	0.7	0.2	0.0	2.4	3.2	3.3	0.4	3.1	1.8	2.1	0.4
500 FT. FLYOVER -- TARGET IAS 123KTS.													
C10	90.5	83.3	7.2	6.9	0.5	95.0	97.0	98.0	6.7	97.6	11.0	11.0	1.4
C11	90.0	82.9	7.2	6.5	0.4	94.5	96.5	97.4	6.5	97.1	13.0	12.5	1.4
C12	90.8	83.7	7.1	6.7	0.4	95.3	97.3	97.6	6.9	97.6	11.5	13.0	0.3
C13	90.6	84.4	6.2	6.7	0.5	95.4	98.2	99.5	6.3	98.6	8.5	8.5	1.8
C14	90.0	83.4	6.6	6.6	0.5	94.4	96.7	98.1	6.2	96.9	10.0	10.5	1.4
C15	89.3	82.0	7.3	7.0	0.5	93.6	95.5	95.9	7.3	96.3	11.0	11.5	0.4
Avg.	90.2	83.3	6.9	6.7	0.5	94.7	96.9	97.7	6.7	97.3	10.8	11.2	1.1
Std Dv	0.5	0.8	0.4	0.2	0.0	0.7	0.9	1.2	0.4	0.8	1.5	1.6	0.6
90% CI	0.4	0.7	0.3	0.2	0.0	0.6	0.7	1.0	0.3	0.7	1.2	1.3	0.5
500 FT. FLYOVER -- TARGET IAS 110KTS.													
D16	88.9	82.0	6.9	6.5	0.4	93.1	95.5	96.7	6.2	96.3	11.5	11.0	1.9
D17	89.1	81.6	7.5	7.0	0.5	93.4	95.2	96.6	6.4	96.1	12.0	11.5	1.7
D18	90.1	82.9	7.1	6.5	0.4	94.4	96.6	97.3	6.4	97.1	12.5	13.5	1.7
Avg.	89.4	82.2	7.2	6.7	0.4	93.6	95.7	96.8	6.3	96.5	12.0	12.0	1.8
Std Dv	0.6	0.7	0.3	0.3	0.0	0.7	0.7	0.4	0.1	0.6	0.5	1.3	0.1
90% CI	1.0	1.1	0.5	0.4	0.0	1.2	1.2	0.6	0.2	0.9	0.8	2.2	0.2
500 FT. FLYOVER -- TARGET IAS 96KTS.													
E19	----------		NO DATA		----------								
Avg.	-	-	-	-	-	-	-	-	-	-	-	-	-
Std Dv	-	-	-	-	-	-	-	-	-	-	-	-	-
90% CI	-	-	-	-	-	-	-	-	-	-	-	-	-

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-1G.5

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/22/83

SITE: 1G CENTERLINE-CENTER (FLUSH) JUNE 15,1983

EV	SEL	AL■	SEL-AL■	K(A)	Q	EPNL	PNL■	PNLT■	K(P)	OASPL■	DUR(A)	DUR(P)	TC
1000 FT. FLYOVER -- TARGET IAS 123KTS.													
A1	85.4	74.6	10.8	8.0	0.5	89.1	88.1	88.8	7.7	89.9	22.5	22.0	0.7
A2	84.6	73.4	11.2	8.0	0.5	88.2	86.7	87.4	7.7	88.8	26.0	25.0	0.8
A3	84.8	74.0	10.8	7.8	0.5	98.3	87.0	87.7	7.8	89.1	23.5	22.5	0.7
A4	84.0	73.9	10.1	7.4	0.4	87.8	87.1	87.8	7.4	88.6	23.5	23.0	0.8
A5	84.5	73.6	10.9	7.6	0.4	88.1	87.1	87.7	7.3	88.6	27.5	27.0	0.6
A6	85.4	74.9	10.5	7.5	0.5	89.2	88.5	89.4	7.3	90.7	24.5	21.5	0.9
Avg.	84.8	74.1	10.7	7.7	0.5	88.5	87.4	88.1	7.5	89.3	24.6	23.5	0.7
Std Dv	0.5	0.6	0.4	0.2	0.0	0.6	0.7	0.8	0.2	0.8	1.9	2.1	0.1
90% CI	0.4	0.5	0.3	0.2	0.0	0.5	0.6	0.6	0.2	0.7	1.5	1.7	0.1
APPROACH -- MULTI-SEG. 1													
Q20	91.5	86.4	5.1	6.3	0.5	96.1	100.5	101.3	5.8	101.1	6.5	6.5	0.9
Q21	94.8	89.3	5.4	6.0	0.4	99.7	103.5	104.4	5.9	103.5	8.0	8.0	1.3
Avg.	93.1	87.8	5.3	6.2	0.5	97.9	102.0	102.8	5.9	102.3	7.2	7.2	1.1
Std Dv	2.3	2.1	0.2	0.2	0.0	2.6	2.2	2.2	0.1	1.7	1.1	1.1	0.3
90% CI	10.3	9.3	1.0	0.9	0.2	11.6	9.6	9.6	0.3	7.6	4.7	4.7	1.3
APPROACH -- MULTI-SEG. 2													
R22	94.0	87.6	6.4	6.6	0.5	99.4	102.4	103.0	6.9	101.5	9.5	8.5	0.6
Avg.	94.0	87.6	6.4	6.6	0.5	99.4	102.4	103.0	6.9	101.5	9.5	8.5	0.6
Std Dv	-	-	-	-	-	-	-	-	-	-	-	-	-
90% CI	-	-	-	-	-	-	-	-	-	-	-	-	-
APPROACH -- MULTI-SEG. 3													
S23	99.3	92.7	6.6	6.6	0.5	103.3	105.4	106.4	6.6	103.4	10.0	11.0	1.0
Avg.	99.3	92.7	6.6	6.6	0.5	103.3	105.4	106.4	6.6	103.4	10.0	11.0	1.0
Std Dv	-	-	-	-	-	-	-	-	-	-	-	-	-
90% CI	-	-	-	-	-	-	-	-	-	-	-	-	-

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-2.1

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/18/83

SITE: 2 SIDELINE - 150 M. SOUTH JUNE 14,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
12 DEGREE APPROACH -- TARGET IAS 45KTS.													
T27	91.0	82.7	8.4	6.2	0.3	95.3	96.2	97.1	6.1	94.0	22.5	22.0	0.9
T28	90.0	82.0	8.0	5.7	0.3	94.2	95.4	96.4	5.7	93.4	24.5	23.5	0.9
T29	91.7	83.0	8.7	6.9	0.4	95.8	96.5	97.4	6.8	93.9	18.0	17.0	0.9
Avg.	90.9	82.6	8.3	6.3	0.3	95.1	96.0	96.9	6.2	93.8	21.7	20.8	0.9
Std Dv	0.9	0.5	0.4	0.6	0.1	0.8	0.5	0.5	0.6	0.3	3.3	3.4	0.0
90% CI	1.5	0.9	0.6	1.0	0.1	1.4	0.9	0.9	1.0	0.5	5.6	5.7	0.0
12 DEGREE APPROACH -- TARGET IAS 55KTS.													
U30	90.2	80.8	9.3	7.2	0.4	94.6	94.8	95.9	6.9	92.8	19.5	19.0	1.1
U31	91.0	81.6	9.5	7.5	0.5	95.2	94.5	95.4	7.7	92.6	18.0	19.5	0.9
U32	90.2	82.7	7.5	6.4	0.4	94.4	96.3	97.1	6.6	94.2	15.0	13.0	0.8
Avg.	90.5	81.7	8.8	7.1	0.4	94.8	95.2	96.1	7.0	93.2	17.5	17.2	0.9
Std Dv	0.5	0.9	1.1	0.6	0.1	0.4	1.0	0.9	0.6	0.9	2.3	3.6	0.1
90% CI	0.8	1.6	1.8	1.0	0.1	0.7	1.6	1.5	0.9	1.5	3.9	6.1	0.2
12 DEGREE APPROACH -- TARGET IAS 65KTS.													
V33	88.9	81.2	7.7	7.2	0.5	93.4	95.3	96.1	7.0	93.9	11.5	11.0	0.7
V34	88.7	81.1	7.7	7.0	0.5	93.3	94.9	95.6	7.1	93.5	12.5	12.0	0.7
V35	89.1	81.3	7.8	6.9	0.4	93.5	95.1	95.8	6.9	93.4	13.5	13.0	0.8
Avg.	88.9	81.2	7.7	7.0	0.5	93.4	95.1	95.8	7.0	93.6	12.5	12.0	0.7
Std Dv	0.2	0.1	0.0	0.2	0.0	0.1	0.2	0.2	0.1	0.2	1.0	1.0	0.0
90% CI	0.3	0.2	0.1	0.3	0.1	0.2	0.4	0.4	0.2	0.4	1.7	1.7	0.0
12 DEGREE APPROACH -- TARGET IAS 75KTS.													
W36	88.6	80.4	8.2	7.1	0.5	92.8	93.9	94.9	6.9	92.6	14.0	13.5	1.1
W37	88.4	80.8	7.6	6.7	0.4	92.9	94.3	95.5	6.6	92.7	13.5	13.0	1.2
W38	88.5	81.0	7.5	6.6	0.4	92.7	94.4	95.7	6.6	92.7	13.5	11.5	1.2
W40	88.5	80.2	8.3	7.1	0.5	92.7	94.1	95.2	6.6	91.8	15.0	14.0	1.1
Avg.	88.5	80.6	7.9	6.9	0.4	92.8	94.2	95.3	6.7	92.5	14.0	13.0	1.2
Std Dv	0.1	0.4	0.4	0.2	0.0	0.1	0.3	0.3	0.2	0.4	0.7	1.1	0.1
90% CI	0.1	0.4	0.5	0.3	0.0	0.1	0.3	0.4	0.2	0.5	0.8	1.3	0.1

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-2.2

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/18/83

SITE: 2 SIDELINE - 150 M. SOUTH JUNE 14,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
6 DEGREE APPROACH -- TARGET IAS 45KTS.													
N7	86.4	75.2	[illegible]	7.7	0.5	90.3	88.3	89.6	7.5	93.0	28.0	27.0	1.7
N8	85.0	74.1	11.0	6.8	0.3	88.4	86.4	88.1	7.1	92.5	41.5	28.0	1.7
N9	85.6	74.6	11.0	7.1	0.4	89.5	88.0	89.3	6.6	92.0	35.5	35.0	1.1
Avg.	85.7	74.6	11.1	7.2	0.4	89.4	87.6	89.0	7.0	92.5	35.0	30.0	1.5
Std Dv	0.7	0.6	0.1	0.5	0.1	1.0	1.0	0.8	0.4	0.5	6.8	4.4	0.4
90% CI	1.2	0.9	0.2	0.8	0.1	1.7	1.7	1.4	0.7	0.9	11.4	7.3	0.6
6 DEGREE APPROACH -- TARGET IAS 55KTS.													
N10	87.1	78.0	9.1	7.0	0.4	91.7	91.8	93.5	6.6	92.5	20.0	18.0	1.6
N11	85.6	75.8	9.7	7.2	0.4	90.0	89.7	91.1	6.8	93.2	22.0	20.5	1.3
N12	89.5	80.7	8.7	6.8	0.4	94.2	94.1	95.9	6.7	92.5	19.0	17.5	1.7
N13	86.0	75.5	10.4	7.4	0.4	90.7	89.7	91.3	6.9	92.0	25.5	23.5	1.6
Avg.	87.0	77.5	9.5	7.1	0.4	91.6	91.3	92.9	6.7	92.6	21.6	19.9	1.6
Std Dv	1.8	2.4	0.7	0.3	0.0	1.8	2.1	2.2	0.1	0.5	2.9	2.7	0.2
90% CI	2.1	2.8	0.9	0.3	0.0	2.2	2.5	2.6	0.2	0.6	3.4	3.2	0.2
6 DEGREE APPROACH -- TARGET IAS 75KTS.													
O14	90.5	82.6	7.9	7.2	0.5	95.0	95.6	97.0	7.3	93.2	12.5	12.5	1.4
O15	89.2	81.0	8.2	7.7	0.6	94.0	94.5	96.0	7.5	92.4	11.5	11.5	1.5
O16	89.5	81.0	8.5	7.3	0.5	94.3	94.7	96.2	7.2	93.1	14.5	13.0	1.6
Avg.	89.7	81.5	8.2	7.4	0.5	94.4	94.9	96.4	7.3	92.9	12.8	12.3	1.5
Std Dv	0.7	0.9	0.3	0.3	0.0	0.5	0.6	0.5	0.2	0.4	1.5	0.8	0.1
90% CI	1.2	1.6	0.5	0.4	0.1	0.9	1.0	0.8	0.3	0.7	2.6	1.3	0.1
6 DEGREE APPROACH -- TARGET IAS 85KTS.													
P17	88.8	81.1	7.7	6.8	0.4	93.0	94.6	95.9	6.9	93.2	13.5	11.0	1.7
P18	88.4	80.9	7.6	6.8	0.4	92.6	94.2	95.1	6.8	92.7	13.0	12.5	0.9
P19	88.2	80.4	7.8	6.5	0.4	92.2	93.8	94.8	6.4	92.9	15.5	14.5	1.0
Avg.	88.5	80.8	7.7	6.7	0.4	92.6	94.2	95.3	6.7	93.0	14.0	12.7	1.2
Std Dv	0.3	0.3	0.1	0.2	0.0	0.4	0.4	0.6	0.3	0.2	1.3	1.8	0.4
90% CI	0.5	0.6	0.2	0.3	0.0	0.7	0.7	1.0	0.5	0.4	2.2	3.0	0.7

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-2.3

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/17/83

SITE: 2 SIDELINE - 150 M. SOUTH JUNE 14,1983

EV	SEL	AL*	SEL-AL*	K(A)	Q	EPNL	PNL*	PNLT*	K(P)	OASPL*	DUR(A)	DUR(P)	TC
6 DEGREE APPROACH -- TARGET IAS 65KTS. (ICAO)													
L1	90.0	80.0	10.0	7.5	0.5	94.2	94.2	95.1	7.6	93.9	21.5	16.0	0.9
L2	88.7	78.8	9.9	7.6	0.5	93.2	92.3	93.3	7.9	92.9	20.5	18.0	1.8
L3	87.7	80.1	7.6	6.3	0.4	92.2	92.7	93.6	7.1	93.1	16.5	16.5	1.0
L4	89.0	79.9	9.0	7.3	0.5	93.3	92.6	94.5	7.6	93.8	17.5	14.5	1.8
L5	88.3	78.4	9.9	7.4	0.4	92.8	92.3	93.8	7.4	92.7	22.0	16.5	1.5
L6	88.7	79.0	9.7	7.6	0.5	93.4	92.8	94.3	7.6	93.5	19.0	15.5	1.4
Avg.	88.7	79.4	9.4	7.3	0.4	93.2	92.8	94.1	7.5	93.3	19.5	16.2	1.4
Std Dv	0.8	0.7	0.9	0.5	0.1	0.7	0.7	0.7	0.3	0.5	2.2	1.2	0.4
90% CI	0.6	0.6	0.8	0.4	0.0	0.6	0.6	0.5	0.2	0.4	1.8	1.0	0.3
TAKEOFF -- TARGET IAS 65KTS. (ICAO)													
K20	83.2	72.7	10.5	7.5	0.4	88.3	86.2	88.9	6.9	85.7	25.5	23.0	2.6
K21	83.1	73.0	10.1	7.2	0.4	88.1	86.4	88.8	6.7	86.2	25.0	24.0	2.4
K22	82.5	72.2	10.3	7.3	0.4	87.6	85.4	88.1	7.0	85.4	25.5	23.0	2.7
K23	82.7	72.4	10.3	7.3	0.4	87.9	86.3	99.1	6.8	85.7	26.0	19.5	2.8
K24	82.4	71.9	10.5	7.6	0.5	87.7	85.9	88.3	7.1	84.9	24.5	21.0	2.4
K25	81.7	71.5	10.2	7.3	0.4	87.1	85.1	87.8	7.0	84.6	25.5	22.0	2.7
Avg.	82.6	72.3	10.3	7.4	0.4	87.8	85.9	88.5	6.9	85.4	25.3	22.1	2.6
Std Dv	0.6	0.6	0.2	0.1	0.0	0.4	0.5	0.5	0.1	0.6	0.5	1.6	0.2
90% CI	0.5	0.5	0.1	0.1	0.0	0.3	0.4	0.4	0.1	0.5	0.4	1.3	0.1

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-2.4

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/17/83

SITE: 2 SIDELINE - 150 M. SOUTH JUNE 15,1983

EV	SEL	AL*	SEL-AL*	K(A)	Q	EPNL	PNL*	PNLT*	K(P)	OASPL*	DUR(A)	DUR(P)	TC
500 FT. FLYOVER -- TARGET IAS 137KTS.													
B7	87.2	78.9	8.4	7.3	0.5	91.8	92.1	92.6	7.6	95.9	14.0	16.5	0.4
B8	88.4	80.6	7.8	7.1	0.5	93.3	94.2	95.0	7.3	98.1	12.5	13.5	0.8
B9	88.0	79.7	8.4	7.0	0.4	93.0	93.5	94.1	7.5	97.5	15.5	15.5	0.6
Avg.	87.9	79.7	8.2	7.1	0.5	92.7	93.3	93.9	7.5	97.2	14.0	15.2	0.6
Std Dv	0.6	0.9	0.3	0.1	0.0	0.8	1.1	1.2	0.1	1.1	1.5	1.5	0.2
90% CI	1.0	1.5	0.6	0.2	0.0	1.3	1.8	2.1	0.2	1.9	2.5	2.6	0.3
500 FT. FLYOVER -- TARGET IAS 123KTS.													
C10	86.2	78.6	7.6	6.6	0.4	90.6	91.5	92.2	7.0	95.3	14.5	16.0	0.6
C11	86.3	78.2	8.0	6.3	0.3	90.7	90.9	91.7	6.9	94.7	19.0	20.0	1.0
C12	86.3	78.6	7.8	6.9	0.4	91.1	91.3	91.8	7.2	94.6	13.5	19.5	0.5
C13	87.4	79.8	7.6	6.5	0.4	91.8	92.4	93.5	7.1	95.7	14.5	14.5	1.1
C14	86.3	78.9	7.4	6.7	0.4	90.4	91.6	92.2	7.1	94.7	12.5	14.5	0.7
C15	86.4	78.0	8.4	6.9	0.4	90.7	90.5	91.3	7.6	94.6	16.0	17.5	0.9
Avg.	86.5	78.7	7.8	6.7	0.4	90.9	91.4	92.1	7.1	94.9	15.0	17.0	0.8
Std Dv	0.4	0.6	0.3	0.2	0.0	0.5	0.7	0.7	0.2	0.5	2.3	2.4	0.[illegible]
90% CI	0.4	0.5	0.3	0.2	0.0	0.4	0.5	0.6	0.2	0.4	1.9	2.0	0.[illegible]
500 FT. FLYOVER -- TARGET IAS 110KTS.													
D16	84.5	75.4	9.1	6.7	0.4	88.3	97.4	87.9	7.5	92.4	23.0	24.0	0.5
D17	84.7	75.8	8.9	7.0	0.4	88.6	87.9	88.8	7.5	92.4	19.0	20.5	0.9
D18	84.5	76.2	8.3	6.8	0.4	88.3	88.2	88.9	7.5	92.2	16.5	18.0	0.8
Avg.	84.6	75.8	8.8	6.8	0.4	88.4	87.8	88.5	7.5	92.3	19.5	20.8	0.7
Std Dv	0.1	0.4	0.4	0.1	0.0	0.2	0.4	0.6	0.1	0.1	3.3	3.0	0.2
90% CI	0.2	0.6	0.7	0.2	0.1	0.3	0.7	1.0	0.1	0.2	5.5	5.1	0.3
500 FT. FLYOVER -- TARGET IAS 96KTS.													
E19	83.1	73.9	9.2	7.2	0.4	86.9	85.9	86.7	7.4	89.8	18.5	23.5	0.8
Avg.	83.1	73.9	9.2	7.2	0.4	96.9	85.9	86.7	7.4	89.8	18.5	23.5	0.8
Std Dv	-	-	-	-	-	-	-	-	-	-	-	-	-
90% CI	-	-	-	-	-	-	-	-	-	-	-	-	-

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-2.5

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/18/83

SITE: 2 SIDELINE - 150 M SOUTH JUNE 15,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
1000 FT. FLYOVER -- TARGET IAS 123KTS.													
A1	83.5	73.0	10.5	7.4	0.4	87.7	86.3	87.3	7.3	90.2	26.5	26.5	0.8
A2	82.6	71.8	10.8	7.6	0.5	86.5	85.4	86.1	7.4	89.0	26.0	25.0	0.8
A3	82.5	72.3	10 2	7.3	0.4	86.7	85.3	86.3	7.3	89.2	24.5	26.5	1.0
A4	[illegible]	71.9	10.2	7.2	0.4	85.9	84.6	85.6	7.1	88.7	26.0	28.5	1.0
A5	[illegible]	71.9	11.1	7.6	0.4	87.2	85.5	86.2	7.5	89.2	29.0	28.5	1.0
A6	83.7	72.7	11.0	7.9	0.5	88.1	85.6	86.7	8.1	90.7	25.0	26.0	1.2
Avg.	82.9	72.3	10.6	7.5	0.4	87.0	85.5	86.4	7.5	89.5	26.2	26.8	1.0
Std Dv	0.6	0.5	0.4	0.3	0.0	0.8	0.5	0.6	0.3	0.8	1.6	1.4	0.1
90% CI	0.5	0.4	0.3	0.2	0.0	0.7	0.4	0.5	0.3	0.6	1.3	1.2	0.1
APPROACH -- MULTI-SEG. 1													
Q20	86.7	78.0	8.7	6.8	0.4	90.4	90.3	91.6	7.0	91.8	19.0	18.0	1.4
Q21	87.8	79.2	8.6	7.7	0.6	91.9	92.1	94.0	7.4	92.1	13.0	11.5	1.9
Avg.	87.3	78.6	8.7	7.3	0.5	91.1	91.2	92.8	7.2	92.0	16.0	14.7	1.6
Std Dv	0.8	0.9	0.1	0.6	0.1	1.0	1.3	1.7	0.3	0.2	4.2	4.6	0.4
90% CI	3.6	3.9	0.3	2.9	0.5	4.6	5.9	7.6	1.2	1.1	18.9	20.5	1.6
APPROACH -- MULTI-SEG. 2													
R22	88.2	79.7	8.5	7.1	0.5	92.2	92.4	93.6	7.3	91.5	15.5	15.0	1.4
Avg.	88.2	79.7	8.5	7.1	0.5	92.2	92.4	93.6	7.3	91.5	15.5	15.0	1.4
Std Dv	-	-	-	-	-	-	-	-	-	-	-	-	-
90% CI	-	-	-	-	-	-	-	-	-	-	-	-	-
APPROACH -- MULTI-SEG. 3													
S23	91.3	80.8	10.5	7.9	0.5	95.3	94.1	95.7	7.5	92.1	21.5	19.5	2.0
Avg.	91.3	80.8	10.5	7.9	0.5	95.3	94.1	95.7	7.5	92.1	21.5	19.5	2.0
Std Dv	-	-	-	-	-	-	-	-	-	-	-	-	-
90% CI	-	-	-	-	-	-	-	-	-	-	-	-	-

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-3.1

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/24/83

SITE: 3 SIDELINE - 150 M. NORTH JUNE 14,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
12 DEGREE APPROACH -- TARGET IAS 45KTS.													
T27	85.1	75.2	9.9	6.7	0.3	89.3	89.2	90.0	7.0	87.9	30.0	21.5	0.8
T28	84.6	73.8	10.8	7.3	0.4	88.3	86.5	88.3	6.9	88.2	30.0	27.5	1.9
T29	87.5	76.2	11.3	7.9	0.5	91.4	88.6	90.3	7.8	89.5	26.5	26.0	1.8
Avg.	85.7	75.1	10.6	7.3	0.4	89.7	88.1	89.5	7.2	88.5	28.8	25.0	1.5
Std Dv	1.6	1.2	0.7	0.6	0.1	1.6	1.4	1.1	0.5	0.9	2.0	3.1	0.6
90% CI	2.6	2.0	1.2	1.0	0.2	2.6	2.4	1.8	0.8	1.5	3.4	5.3	1.0
12 DEGREE APPROACH -- TARGET IAS 55KTS.													
U30	83.9	73.8	10.1	7.2	0.4	87.7	85.4	86.4	8.0	89.3	25.5	26.0	1.0
U31	83.7	73.4	10.2	7.7	0.5	87.5	85.6	86.7	7.9	89.1	21.0	23.5	1.3
U32	82.9	73.2	9.7	6.9	0.4	87.1	85.4	86.8	7.4	88.7	25.0	25.0	1.9
Avg.	83.5	73.5	10.0	7.3	0.4	87.4	85.5	86.7	7.7	89.0	23.8	24.8	1.4
Std Dv	0.5	0.3	0.3	0.4	0.1	0.3	0.1	0.2	0.3	0.3	2.5	1.3	0.5
90% CI	0.9	0.5	0.5	0.7	0.1	0.5	0.1	0.3	0.5	0.5	4.2	2.1	0.8
12 DEGREE APPROACH -- TARGET IAS 65KTS.													
V33	83.0	73.2	9.8	6.5	0.3	86.5	84.9	86.5	6.7	88.9	32.0	32.0	1.8
V34	82.3	73.6	8.7	7.3	0.5	-	85.4	86.5	-	89.5	15.5	-	1.1
V35	83.3	74.8	8.5	6.7	0.4	86.9	86.7	87.4	6.9	88.5	18.5	24.0	0.7
Avg.	82.9	73.9	9.0	6.8	0.4	86.7	85.6	86.8	6.8	89.0	22.0	28.0	1.2
Std Dv	0.5	0.9	0.7	0.4	0.1	0.3	1.0	0.5	0.2	0.5	8.8	5.7	0.5
90% CI	0.9	1.4	1.2	0.7	0.2	1.3	1.6	0.9	0.8	0.9	14.8	25.3	0.9
12 DEGREE APPROACH -- TARGET IAS 75KTS.													
W36	83.3	74.7	8.6	7.0	0.4	86.6	86.9	87.7	7.2	90.1	16.5	17.5	0.8
W37	83.6	74.8	8.8	7.3	0.5	87.3	86.9	88.1	7.6	91.4	16.0	16.0	1.9
W38	83.1	74.9	8.2	7.0	0.4	87.0	86.7	87.8	6.9	91.1	15.0	21.5	1.1
W40	83.2	76.0	7.2	6.3	0.4	86.5	87.5	88.0	6.9	89.9	14.0	17.0	0.5
Avg.	83.3	75.1	8.2	6.9	0.4	86.8	87.0	87.9	7.1	90.6	15.4	18.0	1.1
Std Dv	0.2	0.6	0.7	0.4	0.0	0.4	0.4	0.2	0.3	0.8	1.1	2.4	0.6
90% CI	0.2	0.7	0.8	0.5	0.0	0.4	0.4	0.3	0.4	0.9	1.3	2.8	0.7

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-3.2

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/24/83

SITE: 3 SIDELINE - 150 M. NORTH JUNE 14,1983

EV	SEL	AL*	SEL-AL*	K(A)	Q	EPNL	PNL*	PNLT*	K(P)	OASPL*	DUR(A)	DUR(P)	TC
6 DEGREE APPROACH -- TARGET IAS 45KTS.													
M7	88.2	80.2	8.0	6.0	0.3	92.3	92.1	93.8	6.4	91.5	21.5	21.0	1.9
M8	86.0	74.0	12.0	8.0	0.5	89.8	86.7	88.1	7.9	91.1	32.0	30.5	1.9
M9	88.2	76.8	11.4	7.6	0.4	92.2	89.4	90.9	7.7	90.0	31.5	28.5	1.6
Avg.	87.5	77.0	10.5	7.2	0.4	91.4	89.4	90.9	7.4	90.9	28.3	26.7	1.8
Std Dv	1.2	3.1	2.2	1.1	0.1	1.4	2.7	2.9	0.8	0.8	5.9	5.0	0.2
90% CI	2.1	5.2	3.7	1.8	0.2	2.3	4.6	4.8	1.4	1.3	10.0	8.4	0.3
6 DEGREE APPROACH -- TARGET IAS 55KTS.													
N10	89.1	78.0	11.1	8.3	0.6	93.5	92.2	93.2	7.8	89.5	22.0	20.5	1.0
N11	87.1	77.2	9.9	7.4	0.5	91.5	90.3	92.0	7.2	88.8	21.5	20.5	1.8
N12	86.1	75.7	10.4	7.1	0.4	90.8	90.2	92.0	6.8	89.3	29.5	19.5	1.8
N13	87.1	75.1	12.0	7.7	0.4	91.2	89.0	90.4	7.6	89.8	35.5	26.0	2.1
Avg.	87.4	76.5	10.9	7.6	0.5	91.8	90.4	91.9	7.4	89.3	27.1	21.6	1.7
Std Dv	1.3	1.3	0.9	0.5	0.1	1.2	1.3	1.1	0.5	0.4	6.7	3.0	0.5
90% CI	1.5	1.6	1.0	0.6	0.1	1.4	1.5	1.3	0.5	0.5	7.9	3.5	0.5
6 DEGREE APPROACH -- TARGET IAS 75KTS.													
O14	86.9	76.9	10.0	7.6	0.5	90.9	89.2	91.6	7.4	90.0	20.0	17.5	2.4
O15	-	78.3	-	-	-	-	90.6	92.7	-	90.5	-	-	2.3
O16	86.1	76.5	9.6	6.6	0.3	90.0	89.3	90.1	6.9	89.7	28.0	27.5	1.2
Avg.	86.5	77.2	9.8	7.1	0.4	90.4	89.7	91.5	7.1	90.1	24.0	22.5	2.0
Std Dv	0.6	0.9	0.2	0.7	0.1	0.6	0.8	1.3	0.4	0.4	5.7	7.1	0.6
90% CI	2.5	1.6	1.0	3.2	0.5	2.7	1.3	2.2	1.8	0.6	25.3	31.6	1.1
6 DEGREE APPROACH -- TARGET IAS 85KTS.													
P17	84.0	75.4	8.7	7.1	0.4	88.2	88.1	89.9	7.0	90.7	16.5	15.5	1.8
P18	84.9	76.9	8.0	6.8	0.4	89.2	89.9	91.4	6.6	89.9	15.0	15.0	1.6
P19	83.8	75.9	7.9	6.7	0.4	87.9	89.0	90.5	6.4	88.1	15.0	14.0	1.6
Avg.	84.2	76.1	8.2	6.9	0.4	88.4	89.0	90.6	6.7	89.6	15.5	14.8	1.6
Std Dv	0.6	0.8	0.4	0.2	0.0	0.7	0.9	0.8	0.3	1.3	0.9	0.8	0.2
90% CI	1.0	1.3	0.7	0.4	0.0	1.1	1.5	1.3	0.5	2.3	1.5	1.3	0.3

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-3.3

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/22/83

SITE: 3 SIDELINE - 150 M. NORTH JUNE 14,1983

EV	SEL	AL*	SEL-AL*	K(A)	Q	EPNL	PNL*	PNLT*	K(P)	OASPL*	DUR(A)	DUR(P)	TC
6 DEGREE APPROACH -- TARGET IAS 65KTS. (ICAO)													
L1	85.6	75.9	9.6	7.2	0.4	89.7	88.8	90.9	7.1	90.0	22.0	18.0	2.1
L2	87.2	76.8	10.4	7.6	0.5	91.3	89.6	90.6	7.8	89.9	23.5	23.5	1.0
L3	87.2	77.2	10.0	6.9	0.4	91.4	89.2	91.2	7.0	90.4	28.5	28.5	2.4
L4	85.7	77.1	8.6	7.0	0.4	90.2	90.2	91.7	7.1	90.7	17.0	16.0	1.5
L5	86.5	76.4	10.1	7.1	0.4	90.5	88.9	91.0	7.4	90.4	26.5	19.0	2.2
L6	86.5	76.1	10.3	7.6	0.5	90.8	89.4	91.4	7.2	90.3	23.0	20.0	2.1
Avg.	86.4	76.6	9.8	7.2	0.4	90.7	89.3	91.1	7.3	90.3	23.4	20.8	1.9
Std Dv	0.7	0.5	0.7	0.3	0.0	0.6	0.5	0.4	0.3	0.3	4.0	4.5	0.5
90% CI	0.6	0.4	0.6	0.2	0.0	0.5	0.4	0.3	0.2	0.2	3.3	3.7	0.4
TAKEOFF -- TARGET IAS 65KTS. (ICAO)													
K20	82.3	73.1	9.2	6.9	0.4	86.4	85.3	87.8	6.8	84.3	21.0	19.0	2.5
K21	82.4	72.5	9.9	7.5	0.5	86.1	84.6	86.9	7.2	85.3	20.5	19.5	2.2
K22	82.1	71.9	10.2	7.1	0.4	86.1	84.4	86.9	6.8	84.6	27.0	22.0	2.6
K23	82.3	72.7	10.1	7.6	0.5	86.4	84.2	86.6	7.5	83.6	21.0	19.5	2.4
K24	82.4	72.2	10.1	7.3	0.4	86.3	84.4	86.7	7.1	83.2	24.0	22.5	2.4
K25	82.2	72.1	10.1	7.2	0.4	86.2	84.1	86.6	6.9	83.6	26.0	24.5	2.5
Avg.	82.3	72.3	9.9	7.3	0.4	86.2	94.5	86.9	7.0	84.1	23.2	21.2	2.4
Std Dv	0.1	0.4	0.4	0.3	0.0	0.1	0.4	0.4	0.3	0.8	2.8	2.2	0.1
90% CI	0.1	0.3	0.3	0.2	0.0	0.1	0.4	0.4	0.2	0.6	2.3	1.8	0.1

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-3.4

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/17/83

SITE: 3 SIDELINE - 150 M. NORTH JUNE 15,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
500 FT. FLYOVER -- TARGET IAS 137KTS.													
B7	85.7	77.8	7.9	6.7	0.4	89.6	89.9	90.7	6.9	91.8	15.0	19.5	0.8
B8	86.5	79.4	7.2	6.2	0.4	90.4	91.2	92.7	6.6	93.5	14.0	14.5	1.6
B9	86.3	79.2	7.1	6.6	0.4	90.3	90.9	92.2	7.3	92.4	12.0	13.0	1.6
Avg.	86.2	78.8	7.4	6.5	0.4	90.1	90.6	91.9	6.9	92.6	13.7	15.7	1.3
Std Dv	0.5	0.9	0.4	0.2	0.0	0.4	0.7	1.1	0.3	0.9	1.5	3.4	0.4
90% CI	0.8	1.5	0.7	0.4	0.0	0.7	1.1	1.8	0.6	1.5	2.6	5.7	0.7
500 FT. FLYOVER -- TARGET IAS 123KTS.													
C10	85.4	77.7	7.8	6.5	0.4	89.4	89.5	91.2	6.9	91.3	15.5	16.0	1.7
C11	85.0	77.7	7.3	6.5	0.4	88.7	89.8	91.5	6.5	90.9	13.0	12.5	1.7
C12	85.9	76.9	9.0	7.4	0.5	90.3	88.9	90.1	8.3	92.2	16.5	17.0	1.4
C13	85.2	77.3	7.9	6.9	0.4	89.1	88.9	89.5	8.0	91.7	14.0	16.0	0.9
C14	85.6	78.1	7.5	6.2	0.4	89.7	89.9	91.7	6.3	91.3	16.0	18.5	1.8
C15	85.1	77.1	8.0	6.5	0.4	89.0	88.9	90.2	7.2	91.1	17.0	17.0	1.4
Avg.	85.4	77.4	7.9	6.7	0.4	89.4	89.3	90.7	7.2	91.4	15.3	16.2	1.5
Std Dv	0.3	0.5	0.6	0.4	0.0	0.6	0.5	0.9	0.8	0.5	1.5	2.0	0.3
90% CI	0.3	0.4	0.5	0.3	0.0	0.5	0.4	0.7	0.7	0.4	1.3	1.7	0.3
500 FT. FLYOVER -- TARGET IAS 110KTS.													
D16	84.1	75.4	8.8	7.2	0.5	87.9	87.2	88.7	7.4	90.4	16.5	17.5	1.4
D17	83.8	75.8	8.0	6.8	0.4	87.8	87.2	88.7	6.9	89.9	15.0	20.5	1.5
D18	84.0	75.4	8.7	7.1	0.4	87.6	87.0	88.3	7.4	90.1	16.5	18.0	1.4
Avg.	84.0	75.5	8.5	7.0	0.4	87.8	87.2	88.6	7.3	90.1	16.0	18.7	1.4
Std Dv	0.2	0.3	0.4	0.2	0.0	0.1	0.1	0.2	0.3	0.2	0.9	1.6	0.1
90% CI	0.3	0.4	0.7	0.3	0.0	0.2	0.2	0.3	0.5	0.4	1.5	2.7	0.1
500 FT. FLYOVER -- TARGET IAS 96KTS.													
E19	83.3	74.1	9.2	7.2	0.4	87.1	86.6	87.5	7.5	89.2	19.0	18.5	1.0
Avg.	83.3	74.1	9.2	7.2	0.4	87.1	86.6	87.5	7.5	89.2	19.0	18.5	1.0
Std Dv	-	-	-	-	-	-	-	-	-	-	-	-	-
90% CI	-	-	-	-	-	-	-	-	-	-	-	-	-

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-3.5

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/24/83

SITE: 3 SIDELINE - 150 M. NORTH JUNE 15,1983

EV	SEL	AL*	SEL-AL*	K(A)	Q	EPNL	PNL*	PNLT*	K(P)	OASPL*	DUR(A)	DUR(P)	TC
1000 FT. FLYOVER -- TARGET IAS 123KTS.													
A1	82.5	72.5	9.9	7.3	0.4	86.6	84.7	85.8	7.6	87.4	23.0	27.0	1.3
A2	81.6	71.7	9.9	7.4	0.5	85.6	83.9	84.9	7.5	86.5	21.5	26.0	1.1
A3	82.1	71.7	10.4	7.5	0.5	85.9	83.8	85.3	7.7	86.7	24.0	24.0	1.7
A4	81.5	72.3	9.2	7.0	0.4	85.6	84.2	86.1	6.9	86.4	20.5	24.0	1.9
A5	82.0	71.2	10.8	7.5	0.4	-	83.7	85.0	-	86.4	27.5	-	1.7
A6	82.9	72.2	10.7	7.7	0.5	86.8	85.1	86.1	7.8	88.0	24.5	24.0	1.4
Avg.	82.1	71.9	10.2	7.4	0.4	86.1	84.2	85.5	7.5	86.9	23.5	25.0	1.5
Std Dv	0.5	0.5	0.6	0.2	0.0	0.6	0.6	0.5	0.3	0.6	2.5	1.4	0.3
90% CI	0.4	0.4	0.5	0.2	0.0	0.5	0.5	0.4	0.3	0.5	2.0	1.3	0.3
APPROACH -- MULTI-SEG. 1													
Q20	84.4	76.2	8.1	7.0	0.4	87.9	88.6	90.3	6.6	90.6	14.5	14.0	1.8
Q21	84.7	77.4	7.4	6.7	0.4	88.3	89.3	90.6	6.8	91.1	12.5	13.5	1.2
Avg.	84.6	76.8	7.7	6.9	0.4	88.1	88.9	90.4	6.7	90.8	13.5	13.7	1.5
Std Dv	0.2	0.8	0.5	0.2	0.0	0.3	0.5	0.3	0.1	0.4	1.4	0.4	0.4
90% CI	1.1	3.5	2.4	0.9	0.0	1.3	2.3	1.2	0.4	1.7	6.3	1.6	1.7
APPROACH -- MULTI-SEG. 2													
R22	84.2	75.1	9.2	7.2	0.4	87.6	86.8	88.1	7.4	90.2	19.0	19.0	1.4
Avg.	84.2	75.1	9.2	7.2	0.4	87.6	86.8	88.1	7.4	90.2	19.0	19.0	1.4
Std Dv	-	-	-	-	-	-	-	-	-	-	-	-	-
90% CI	-	-	-	-	-	-	-	-	-	-	-	-	-
APPROACH -- MULTI-SEG. 3													
S23	85.3	73.4	11.9	7.2	0.3	89.3	86.3	87.5	7.6	88.2	45.0	35.0	1.1
Avg.	85.3	73.4	11.9	7.2	0.3	89.3	86.3	87.5	7.6	88.2	45.0	35.0	1.1
Std Dv	-	-	-	-	-	-	-	-	-	-	-	-	-
90% CI	-	-	-	-	-	-	-	-	-	-	-	-	-

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-4.1

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/18/83

SITE: 4 CENTERLINE - 150 M. WEST JUNE 14,1983

EV	SEL	ALm	SEL-ALm	K(A)	Q	EPNL	PNLm	PNLTm	K(P)	OASPLm	DUR(A)	DUR(P)	TC
12 DEGREE APPROACH -- TARGET IAS 45KTS.													
T27	89.9	80.5	9.3	6.5	0.3	94.1	94.4	95.4	6.5	92.4	27.0	21.5	1.0
T28	89.6	79.4	10.2	7.2	0.4	94.0	93.2	94.2	7.0	91.8	25.5	24.5	1.1
T29	93.1	82.7	10.4	7.7	0.5	96.7	96.0	96.9	7.5	94.5	22.0	21.0	0.8
Avg.	90.8	80.9	10.0	7.2	0.4	94.9	94.5	95.5	7.0	92.9	24.8	22.3	1.0
Std Dv	1.9	1.7	0.6	0.6	0.1	1.6	1.4	1.3	0.5	1.4	2.6	1.9	0.1
90% CI	3.3	2.8	0.9	1.0	0.1	2.6	2.4	2.2	0.8	2.4	4.3	3.2	0.2
12 DEGREE APPROACH -- TARGET IAS 55KTS.													
U30	89.0	79.7	9.3	7.1	0.4	93.9	93.8	94.9	7.3	93.1	20.5	16.5	1.1
U31	90.6	83.1	7.5	6.9	0.5	95.9	96.2	97.9	7.3	94.2	12.5	12.5	1.7
U32	87.8	78.9	9.0	7.1	0.4	92.3	93.1	94.0	6.7	92.8	18.5	17.0	0.9
Avg.	89.2	80.6	8.6	7.0	0.4	94.0	94.4	95.6	7.1	93.3	17.2	15.3	1.2
Std Dv	1.4	2.2	0.9	0.1	0.0	1.8	1.6	2.0	0.3	0.7	4.2	2.5	0.4
90% CI	2.4	3.8	1.6	0.2	0.0	3.0	2.7	3.4	0.6	1.2	7.0	4.2	0.7
12 DEGREE APPROACH -- TARGET IAS 65KTS.													
V33	85.9	77.7	8.2	6.9	0.4	90.9	92.4	93.2	6.7	91.4	15.5	14.0	0.8
V34	86.4	77.4	9.0	7.0	0.4	91.6	92.4	93.6	6.8	91.2	19.5	15.0	1.2
V35	87.4	78.0	9.4	7.3	0.5	92.4	93.1	94.3	7.0	91.6	19.0	14.5	1.2
Avg.	86.6	77.7	8.9	7.1	0.4	91.6	92.6	93.7	6.8	91.4	18.0	14.5	1.1
Std Dv	0.7	0.3	0.6	0.2	0.0	0.8	0.4	0.5	0.1	0.2	2.2	0.5	0.3
90% CI	1.2	0.5	1.0	0.4	0.0	1.3	0.7	0.9	0.2	0.4	3.7	0.8	0.4
12 DEGREE APPROACH -- TARGET IAS 75KTS.													
W36	86.9	77.6	9.3	7.4	0.5	91.6	92.1	93.0	7.5	92.1	18.0	14.0	0.8
W37	86.7	78.5	8.2	6.8	0.4	91.4	93.0	94.0	6.5	92.2	16.0	13.5	0.9
W38	86.8	77.8	8.9	7.1	0.4	91.5	92.6	93.5	7.3	92.0	18.0	12.5	1.0
W40	86.7	78.4	8.2	7.2	0.5	91.3	92.7	93.6	7.2	92.6	14.0	11.5	1.0
Avg.	86.8	78.1	8.7	7.1	0.5	91.4	92.6	93.5	7.1	92.2	16.5	12.9	0.9
Std Dv	0.1	0.4	0.5	0.3	0.0	0.2	0.4	0.4	0.4	0.3	1.9	1.1	0.1
90% CI	0.1	0.5	0.6	0.3	0.0	0.2	0.5	0.5	0.5	0.3	2.3	1.3	0.1

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-4.2

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/17/83

SITE: 4 CENTERLINE - 150 M. WEST JUNE 14,1983

EV	SEL	AL*	SEL-AL*	K(A)	Q	EPNL	PNL*	PNLT*	K(P)	OASPL*	DUR(A)	DUR(P)	TC
6 DEGREE APPROACH -- TARGET IAS 45KTS.													
M7	91.8	83.7	8.1	6.0	0.3	96.3	97.0	99.1	6.3	95.2	23.0	14.0	2.1
M8	88.4	77.9	10.5	7.3	0.4	92.8	90.8	91.7	7.7	90.5	27.0	27.0	0.9
M9	89.9	79.9	10.0	6.8	0.3	94.7	92.8	94.0	7.3	92.4	29.5	29.5	1.1
Avg.	90.0	80.5	9.6	6.7	0.3	94.6	93.5	94.9	7.1	92.7	26.5	23.5	1.4
Std Dv	1.7	3.0	1.2	0.7	0.1	1.8	3.2	3.8	0.7	2.3	3.3	8.3	0.6
90% CI	2.9	5.0	2.1	1.2	0.1	3.0	5.3	6.4	1.2	3.9	5.5	14.0	1.0
6 DEGREE APPROACH -- TARGET IAS 55KTS.													
N10	89.7	80.2	9.5	7.2	0.4	94.5	94.0	94.9	7.3	93.4	21.0	20.5	1.0
N11	90.2	81.3	8.9	7.1	0.4	94.8	95.3	96.2	7.0	94.4	18.0	17.0	0.9
N12	91.9	82.6	9.3	7.1	0.4	96.9	96.1	97.2	7.3	94.9	21.0	20.5	1.1
N13	92.0	83.4	8.6	7.0	0.4	96.6	96.5	97.7	7.3	94.4	17.5	16.5	1.1
Avg.	91.0	81.9	9.1	7.1	0.4	95.7	95.5	96.5	7.2	94.3	19.4	18.6	1.0
Std Dv	1.2	1.4	0.4	0.1	0.0	1.2	1.1	1.2	0.2	0.6	1.9	2.2	0.1
90% CI	1.4	1.6	0.5	0.1	0.0	1.4	1.3	1.4	0.2	0.8	2.2	2.6	0.2
6 DEGREE APPROACH -- TARGET IAS 75KTS.													
O14	91.0	83.3	7.7	7.0	0.5	95.5	97.4	98.2	6.6	96.1	13.0	12.5	0.8
O15	90.8	83.9	6.9	6.3	0.4	95.1	97.5	98.0	6.5	95.8	12.5	12.5	0.5
O16	91.3	83.4	7.9	7.1	0.5	95.5	97.1	98.0	7.0	95.8	13.0	12.0	0.8
Avg.	91.0	83.5	7.5	6.8	0.4	95.4	97.4	98.1	6.7	95.9	12.8	12.3	0.7
Std Dv	0.3	0.3	0.6	0.4	0.0	0.2	0.2	0.1	0.2	0.2	0.3	0.3	0.2
90% CI	0.5	0.5	0.9	0.7	0.1	0.4	0.3	0.2	0.4	0.3	0.5	0.5	0.3
6 DEGREE APPROACH -- TARGET IAS 85KTS.													
P17	90.2	81.5	8.7	7.7	0.6	94.6	96.0	97.0	7.0	95.1	13.5	12.5	1.0
P18	90.0	81.9	8.1	7.3	0.5	94.0	95.0	96.3	7.0	94.1	13.0	12.5	1.3
P19	89.9	81.7	8.2	7.4	0.5	93.7	94.1	95.0	7.8	93.2	13.0	13.0	0.8
Avg.	90.0	81.7	8.4	7.5	0.5	94.1	95.0	96.1	7.3	94.1	13.2	12.7	1.0
Std Dv	0.2	0.2	0.3	0.2	0.0	0.5	0.9	1.0	0.5	0.9	0.3	0.3	0.3
90% CI	0.3	0.3	0.5	0.4	0.0	0.8	1.6	1.7	0.8	1.5	0.5	0.5	0.4

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-4.3

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/22/83

SITE: 4 CENTERLINE - 150 M. WEST JUNE 14,1983

EV	SEL	AL*	SEL-AL*	K(A)	Q	EPNL	PNL*	PNLT*	K(P)	OASPL*	DUR(A)	DUR(P)	TC
6 DEGREE APPROACH -- TARGET IAS 65KTS. (ICAO)													
L1	92.8	84.1	8.7	7.2	0.5	96.9	98.0	98.7	7.4	96.4	16.0	13.0	0.7
L2	93.1	85.3	7.8	6.7	0.4	97.4	99.0	100.0	6.6	97.3	14.5	13.5	1.0
L3	92.8	85.0	7.8	6.6	0.4	96.8	98.9	99.6	7.0	98.1	15.0	11.0	0.7
L4	93.2	85.9	7.2	6.8	0.5	97.6	99.7	100.4	6.9	97.8	11.5	11.0	0.7
L5	92.9	85.0	7.9	7.1	0.5	97.4	98.9	99.6	6.9	97.6	13.0	13.0	0.7
L6	93.3	85.3	8.0	7.3	0.5	97.8	99.1	99.9	7.1	97.2	12.5	13.0	0.7
Avg.	93.0	85.1	7.9	7.0	0.5	97.3	98.9	99.7	7.0	97.4	13.7	12.4	0.8
Std Dv	0.2	0.6	0.5	0.3	0.0	0.4	0.6	0.6	0.3	0.6	1.7	1.1	0.1
90% CI	0.2	0.5	0.4	0.2	0.0	0.3	0.5	0.5	0.2	0.5	1.4	0.9	0.1
TAKEOFF -- TARGET IAS 65KTS. (ICAO)													
K20	82.4	71.6	10.8	7.6	0.4	86.5	84.7	87.1	6.9	81.5	27.0	23.0	2.4
K21	82.9	72.2	10.7	7.4	0.4	86.9	85.0	87.1	7.0	81.7	28.0	25.0	2.1
K22	82.1	72.0	10.1	6.8	0.3	86.2	84.0	86.1	7.0	81.2	30.0	27.0	2.1
K23	82.4	70.7	11.8	8.1	0.5	86.4	83.6	86.1	7.5	82.3	28.0	24.5	2.5
K24	82.8	71.8	11.0	7.5	0.4	86.7	84.7	86.7	7.3	81.3	28.5	24.0	2.0
K25	82.2	71.3	10.9	7.3	0.4	86.1	83.2	85.2	7.4	81.3	31.5	29.0	2.0
Avg.	82.5	71.6	10.9	7.5	0.4	86.5	84.2	86.4	7.2	81.6	28.8	25.4	2.2
Std Dv	0.3	0.5	0.5	0.4	0.1	0.3	0.7	0.7	0.2	0.4	1.6	2.2	0.2
90% CI	0.2	0.5	0.4	0.3	0.1	0.3	0.6	0.6	0.2	0.3	1.3	1.8	0.2

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-4.4

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/17/83

SITE: 4 CENTERLINE - 150 M. WEST JUNE 15,1983

EV	SEL	AL*	SEL-AL*	K(A)	Q	EPNL	PNL*	PNLT*	K(P)	OASPL*	DUR(A)	DUR(P)	TC
500 FT. FLYOVER -- TARGET IAS 137KTS.													
B7	86.4	79.0	7.4	6.8	0.5	90.7	92.3	92.9	7.0	92.5	12.0	13.0	1.2
B8	88.0	81.0	7.0	6.7	0.5	92.6	94.4	94.9	6.9	95.1	11.0	12.5	0.9
B9	88.5	81.4	7.1	6.9	0.5	93.1	94.8	95.6	6.9	96.3	11.0	12.5	0.9
Avg.	87.6	80.4	7.2	6.8	0.5	92.1	93.8	94.5	6.9	94.6	11.3	12.7	1.0
Std Dv	1.1	1.3	0.2	0.1	0.0	1.3	1.4	1.4	0.0	2.0	0.6	0.3	0.2
90% CI	1.9	2.1	0.3	0.1	0.0	2.2	2.3	2.3	0.1	3.3	1.0	0.5	0.3
500 FT. FLYOVER -- TARGET IAS 123KTS.													
C10	87.6	80.2	7.5	6.5	0.4	92.2	93.9	94.6	6.6	94.8	14.0	14.5	0.7
C11	86.8	78.9	7.9	7.3	0.5	91.3	92.9	93.6	6.9	94.1	12.0	13.0	0.7
C12	87.6	79.9	7.8	7.0	0.5	92.1	93.6	94.2	7.0	94.6	13.0	13.5	0.7
C13	87.4	80.8	6.6	6.8	0.5	92.0	94.8	95.4	6.4	95.1	9.5	11.0	0.6
C14	86.4	79.4	7.0	6.7	0.5	90.9	93.3	94.1	6.4	94.1	11.0	12.0	1.0
C15	85.7	78.6	7.1	6.6	0.4	90.1	92.2	92.9	6.5	93.0	12.0	12.5	0.8
Avg.	86.9	79.6	7.3	6.8	0.5	91.4	93.5	94.1	6.6	94.3	11.9	12.7	0.7
Std Dv	0.8	0.8	0.5	0.3	0.0	0.8	0.9	0.8	0.2	0.7	1.6	1.2	0.2
90% CI	0.6	0.7	0.4	0.2	0.0	0.7	0.7	0.7	0.2	0.6	1.3	1.0	0.1
500 FT. FLYOVER -- TARGET IAS 110KTS.													
D16	85.3	78.1	7.3	6.9	0.5	89.6	91.7	92.5	6.6	92.0	11.5	12.0	0.8
D17	85.4	77.6	7.8	7.0	0.5	89.7	91.7	92.5	6.6	92.1	13.0	12.5	0.8
D18	85.7	77.5	8.2	7.1	0.5	90.1	91.6	92.4	6.6	91.8	14.5	14.0	0.9
Avg.	85.5	77.7	7.8	7.0	0.5	89.8	91.7	92.5	6.6	92.0	13.0	12.8	0.8
Std Dv	0.2	0.3	0.5	0.1	0.0	0.2	0.1	0.0	0.0	0.1	1.5	1.0	0.0
90% CI	0.3	0.5	0.8	0.2	0.0	0.4	0.1	0.1	0.0	0.2	2.5	1.8	0.0
500 FT. FLYOVER -- TARGET IAS 96KTS.													
E19	85.5	78.9	6.6	6.0	0.4	90.2	93.0	94.3	5.8	91.0	12.5	10.5	1.3
Avg.	85.5	78.9	6.6	6.0	0.4	90.2	93.0	94.3	5.8	91.0	12.5	10.5	1.3
Std Dv	-	-	-	-	-	-	-	-	-	-	-	-	-
90% CI	-	-	-	-	-	-	-	-	-	-	-	-	-

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-4.5

BELL 222 HELICOPTER

DOT/TSC
8/24/83

SUMMARY NOISE LEVEL DATA

AS MEASURED *

SITE: 4 CENTERLINE - 150 M. WEST JUNE 15,1983

EV	SEL	AL*	SEL-AL*	K(A)	Q	EPNL	PNL*	PNLT*	K(P)	OASPL*	DUR(A)	DUR(P)	TC
1000 FT. FLYOVER -- TARGET IAS 123KTS.													
A1	82.8	71.7	11.1	7.9	0.5	86.5	84.8	85.5	7.9	86.9	25.0	25.0	1.1
A2	81.6	70.5	11.1	7.5	0.4	-	83.2	83.9	-	85.9	30.0	-	0.7
A3	81.6	71.0	10.6	7.5	0.4	85.4	84.7	85.6	7.0	86.5	25.5	25.0	0.9
A4	80.7	70.0	10.6	7.5	0.4	-	83.7	84.7	-	84.8	26.5	-	1.0
A5	81.8	70.0	11.8	8.1	0.5	85.6	83.6	84.4	7.7	86.0	29.0	28.0	0.8
A6	82.7	72.7	10.0	7.8	0.5	86.7	86.1	86.9	7.7	88.2	19.5	19.0	0.7
Avg.	81.9	71.0	10.9	7.7	0.5	86.0	84.4	85.2	7.6	86.4	25.9	24.2	0.9
Std Dv	0.8	1.0	0.6	0.2	0.0	0.6	1.1	1.0	0.4	1.2	3.7	3.8	0.1
90% CI	0.6	0.9	0.5	0.2	0.0	0.7	0.9	0.9	0.4	0.9	3.0	4.4	0.1
APPROACH -- MULTI-SEG. 1													
020	91.7	85.2	6.5	6.8	0.5	96.9	100.0	100.9	6.8	98.6	9.0	7.5	1.1
021	90.4	84.2	6.2	6.5	0.5	95.4	98.4	99.2	6.6	97.4	9.0	8.5	0.8
Avg.	91.1	84.7	6.4	6.7	0.5	96.1	99.2	100.1	6.7	98.0	9.0	8.0	1.0
Std Dv	0.9	0.7	0.2	0.2	0.0	1.1	1.2	1.3	0.1	0.8	0.0	0.7	0.2
90% CI	4.2	3.3	1.0	1.0	0.1	4.8	5.2	5.6	0.4	3.5	0.0	3.2	0.9
APPROACH -- MULTI-SEG. 2													
R22	90.1	81.9	8.2	7.1	0.5	95.4	96.9	98.1	6.9	95.7	14.0	11.5	1.2
Avg.	90.1	81.9	8.2	7.1	0.5	95.4	96.9	98.1	6.9	95.7	14.0	11.5	1.2
Std Dv	-	-	-	-	-	-	-	-	-	-	-	-	-
90% CI	-	-	-	-	-	-	-	-	-	-	-	-	-
APPROACH -- MULTI-SEG. 3													
S23	94.5	86.1	8.4	7.1	0.4	98.9	99.0	100.0	7.5	96.5	15.5	15.5	0.9
Avg.	94.5	86.1	8.4	7.1	0.4	98.9	99.0	100.0	7.5	96.5	15.5	15.5	0.9
Std Dv	-	-	-	-	-	-	-	-	-	-	-	-	-
90% CI	-	-	-	-	-	-	-	-	-	-	-	-	-

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-5.1

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/25/83

SITE: 5 CENTERLINE - 188 M. EAST JUNE 14,1983

EV	SEL	AL■	SEL-AL■	K(A)	Q	EPNL	PNL■	PNLT■	K(P)	OASPL■	DUR(A)	DUR(P)	TC
12 DEGREE APPROACH -- TARGET IAS 45KTS.													
T27	94.8	87.9	6.9	6.4	0.4	99.0	100.5	101.3	7.1	98.2	12.0	12.5	0.7
T28	95.8	87.1	8.7	8.0	0.6	100.2	101.3	102.3	7.5	99.3	12.5	11.5	1.0
T29	94.3	87.4	6.9	6.1	0.4	99.0	101.8	102.7	6.1	99.7	13.5	10.5	0.9
Avg.	95.0	87.5	7.5	6.8	0.5	99.4	101.2	102.1	6.9	99.0	12.7	11.5	0.9
Std Dv	0.8	0.4	1.1	1.0	0.1	0.7	0.6	0.8	0.7	0.8	0.8	1.0	0.1
90% CI	1.3	0.7	1.8	1.7	0.2	1.2	1.1	1.3	1.2	1.3	1.3	1.7	0.2
12 DEGREE APPROACH -- TARGET IAS 55KTS.													
U30	93.5	87.8	5.7	6.5	0.5	98.9	101.8	102.9	6.7	100.6	7.5	8.0	1.2
U31	93.0	86.9	6.1	6.8	0.5	98.6	101.6	102.6	6.8	100.4	8.0	7.5	1.0
U32	92.4	84.8	7.7	7.2	0.5	97.9	99.3	100.6	7.0	98.3	11.5	11.0	1.4
Avg.	93.0	86.5	6.5	6.8	0.5	98.5	100.9	102.0	6.9	99.8	9.0	8.8	1.2
Std Dv	0.5	1.6	1.1	0.4	0.0	0.5	1.4	1.2	0.2	1.3	2.2	1.9	0.2
90% CI	0.9	2.7	1.8	0.6	0.0	0.9	2.4	2.1	0.3	2.2	3.7	3.2	0.3
12 DEGREE APPROACH -- TARGET IAS 65KTS.													
V33	89.3	83.4	5.9	7.0	0.6	-	98.5	99.4	-	97.8	7.0	-	1.0
V34	89.4	82.3	7.1	6.8	0.5	-	96.8	97.7	-	97.0	11.0	-	0.9
V35	90.6	83.1	7.5	7.2	0.5	95.9	98.2	98.9	7.0	97.4	11.0	10.0	0.6
Avg.	89.8	82.9	6.8	7.0	0.5	95.9	97.8	98.7	7.0	97.4	9.7	10.0	0.8
Std Dv	0.7	0.6	0.8	0.2	0.0	-	0.9	0.9	-	0.4	2.3	-	0.2
90% CI	1.2	0.9	1.4	0.3	0.1	-	1.5	1.5	-	0.6	3.9	-	0.3
12 DEGREE APPROACH -- TARGET IAS 75KTS.													
W36	89.3	83.3	6.0	6.5	0.5	94.6	98.3	99.1	6.3	98.4	8.5	7.5	0.7
W37	89.8	83.4	6.4	6.9	0.5	95.6	98.4	99.5	7.0	98.1	8.5	7.5	1.1
W38	90.2	84.0	6.2	6.6	0.5	96.1	99.8	100.9	5.9	98.6	8.5	7.5	1.1
W40	89.9	83.8	6.1	6.7	0.5	95.7	99.3	100.3	6.4	98.7	8.0	7.0	1.0
Avg.	89.8	83.6	6.2	6.7	0.5	95.5	98.9	99.9	6.4	98.5	8.4	7.4	1.0
Std Dv	0.4	0.4	0.2	0.2	0.0	0.6	0.7	0.8	0.4	0.3	0.2	0.2	0.2
90% CI	0.4	0.4	0.2	0.2	0.0	0.7	0.8	0.9	0.5	0.3	0.3	0.3	0.2

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-5.2

BELL 222 HELICOPTER

DOT/TSC
8/24/83

SUMMARY NOISE LEVEL DATA

AS MEASURED *

SITE: 5 CENTERLINE - 188 M. EAST JUNE 14,1983

EV	SEL	AL*	SEL-AL*	K(A)	Q	EPNL	PNL*	PNLT*	K(P)	OASPL*	DUR(A)	DUR(P)	TC
6 DEGREE APPROACH -- TARGET IAS 45KTS.													
M7	89.4	79.5	9.9	7.4	0.5	-	94.0	94.8	-	94.2	21.5	-	0.8
M8	89.6	80.7	8.9	7.4	0.5	94.6	95.3	96.2	7.2	94.9	16.0	15.0	0.9
M9	89.1	79.3	9.8	6.9	0.4	93.8	93.6	94.4	7.3	94.0	26.0	20.0	0.9
Avg.	89.4	79.9	9.5	7.3	0.4	94.2	94.3	95.1	7.2	94.4	21.2	17.5	0.9
Std Dv	0.3	0.8	0.6	0.3	0.1	0.5	0.9	0.9	0.1	0.5	5.0	3.5	0.0
90% CI	0.4	1.3	1.0	0.5	0.1	2.4	1.4	1.6	0.4	0.8	8.4	15.8	0.1
6 DEGREE APPROACH -- TARGET IAS 55KTS.													
N10	93.9	85.7	8.2	7.2	0.5	99.0	99.6	101.4	6.8	97.7	13.5	13.0	1.8
N11	92.2	84.2	8.0	7.0	0.5	96.8	97.2	98.7	7.1	96.0	14.0	14.0	1.4
N12	92.3	84.0	8.3	7.0	0.4	97.3	97.6	99.0	7.1	96.3	15.0	15.0	1.3
N13	92.7	85.0	7.7	6.9	0.4	97.8	99.2	100.4	6.7	97.2	13.5	12.5	1.3
Avg.	92.8	84.7	8.1	7.0	0.5	97.7	98.4	99.9	6.9	96.8	14.0	13.6	1.5
Std Dv	0.8	0.8	0.2	0.1	0.0	0.9	1.1	1.3	0.2	0.8	0.7	1.1	0.2
90% CI	0.9	0.9	0.3	0.2	0.0	1.1	1.3	1.5	0.2	1.0	0.8	1.3	0.3
6 DEGREE APPROACH -- TARGET IAS 75KTS.													
O14	92.7	85.0	7.7	7.2	0.5	96.9	99.1	99.7	7.2	98.2	11.5	10.0	0.6
O15	92.8	84.8	8.0	7.2	0.5	97.2	99.5	100.3	6.6	98.6	13.0	11.0	0.8
O16	92.8	85.7	7.1	7.1	0.5	97.5	100.0	100.6	7.0	99.1	10.0	9.5	0.8
Avg.	92.8	85.2	7.6	7.2	0.5	97.2	99.5	100.2	6.9	98.6	11.5	10.2	0.7
Std Dv	0.1	0.5	0.5	0.1	0.0	0.3	0.5	0.5	0.3	0.5	1.5	0.8	0.1
90% CI	0.1	0.8	0.8	0.1	0.0	0.5	0.8	0.8	0.5	0.8	2.5	1.3	0.2
6 DEGREE APPROACH -- TARGET IAS 85KTS.													
P17	91.7	85.6	6.1	6.4	0.5	96.1	99.0	99.6	6.8	98.2	9.0	9.0	0.6
P18	90.2	83.6	6.6	6.4	0.4	94.7	97.0	97.7	6.7	96.6	11.0	11.0	0.8
P19	91.7	84.6	7.2	7.0	0.5	96.0	97.6	98.2	7.8	97.5	10.5	10.0	0.7
Avg.	91.2	84.6	6.6	6.6	0.5	95.6	97.8	98.5	7.1	97.4	10.2	10.0	0.7
Std Dv	0.9	1.0	0.5	0.4	0.0	0.8	1.0	1.0	0.6	0.8	1.0	1.0	0.1
90% CI	1.4	1.7	0.9	0.6	0.1	1.3	1.7	1.6	1.0	1.4	1.8	1.7	0.2

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-5.3

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/22/83

SITE: 5 CENTERLINE - 188 M. EAST JUNE 14,1983

EV	SEL	AL*	SEL-AL*	K(A)	Q	EPNL	PNL*	PNLT*	K(P)	OASPL*	DUR(A)	DUR(P)	TC
6 DEGREE APPROACH -- TARGET IAS 65KTS. (ICAO)													
L1	93.4	86.4	7.0	6.9	0.5	97.9	100.3	101.1	6.9	98.9	10.5	9.5	0.8
L2	94.7	87.2	7.4	7.0	0.5	99.2	101.4	102.1	6.9	99.2	11.5	11.0	0.6
L3	93.9	86.7	7.2	7.1	0.5	98.7	101.1	101.9	6.9	99.6	10.5	10.0	0.7
L4	95.0	88.7	6.2	6.7	0.5	99.6	103.2	103.8	6.4	100.5	8.5	8.0	0.6
L5	94.5	87.1	7.5	7.5	0.6	99.0	101.6	102.4	6.8	99.7	10.0	9.5	0.8
L6	94.3	87.4	7.0	6.8	0.5	98.8	101.6	102.5	6.3	99.5	10.5	10.0	1.0
Avg.	94.3	87.3	7.1	7.0	0.5	98.9	101.6	102.3	6.7	99.6	10.2	9.7	0.7
Std Dv	0.6	0.8	0.5	0.3	0.0	0.6	0.9	0.9	0.3	0.6	1.0	1.0	0.1
90% CI	0.5	0.7	0.4	0.2	0.0	0.5	0.8	0.7	0.2	0.5	0.8	0.8	0.1
TAKEOFF -- TARGET IAS 65KTS. (ICAO)													
K20	85.0	75.8	9.2	7.3	0.5	89.7	89.3	91.5	6.7	86.2	18.0	17.0	2.2
K21	85.6	76.9	8.8	7.1	0.4	90.3	90.5	92.5	6.6	86.7	17.0	15.5	2.2
K22	84.7	74.8	10.0	7.8	0.5	89.2	88.1	90.6	7.0	84.8	19.0	17.5	2.4
K23	85.3	76.0	9.3	7.5	0.5	89.7	89.4	91.5	7.1	86.8	17.5	14.0	2.1
K24	84.9	75.1	9.8	7.5	0.5	89.7	88.8	90.9	7.3	86.8	20.0	17.0	2.3
K25	84.5	75.1	9.4	7.6	0.5	89.3	88.3	90.8	7.1	85.1	17.5	16.0	2.6
Avg.	85.0	75.6	9.4	7.5	0.5	89.7	89.1	91.3	6.9	86.1	18.2	16.2	2.3
Std Dv	0.4	0.8	0.4	0.2	0.0	0.4	0.9	0.7	0.3	0.9	1.1	1.3	0.2
90% CI	0.3	0.6	0.4	0.2	0.0	0.3	0.7	0.6	0.2	0.7	0.9	1.1	0.1

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-5.4

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/18/83

SITE: 5 CENTERLINE - 188 M. EAST JUNE 15,1983

EV	SEL	AL*	SEL-AL*	K(A)	Q	EPNL	PNL*	PNLT*	K(P)	OASPL*	DUR(A)	DUR(P)	TC
500 FT. FLYOVER -- TARGET IAS 137KTS.													
B7	87.2	79.3	7.9	6.9	0.4	91.7	92.6	93.5	7.2	94.2	14.0	14.0	0.9
B8	89.0	81.9	7.1	7.0	0.5	93.7	95.7	96.1	7.4	97.3	10.5	10.5	0.5
B9	88.4	81.4	7.0	6.8	0.5	93.1	95.1	95.6	7.0	96.6	11.0	12.0	0.4
Avg.	88.2	[illegible]	7.4	6.9	0.5	92.9	94.5	95.1	7.2	96.0	11.8	12.2	0.6
Std Dv	0.9	[illegible]	0.5	0.1	0.0	1.0	1.6	1.4	0.2	1.6	1.9	1.8	0.3
90% CI	1.6	2.3	0.8	0.2	0.0	1.7	2.8	2.3	0.4	2.7	3.2	3.0	0.5
500 FT. FLYOVER -- TARGET IAS 123KTS.													
C10	87.3	80.1	7.2	6.6	0.4	92.1	94.1	94.8	6.7	95.6	12.0	12.5	0.6
C11	87.3	79.2	8.1	6.8	0.4	91.9	93.2	94.0	6.7	94.7	16.0	15.5	0.7
C12	87.0	79.6	7.4	6.8	0.5	91.8	93.7	94.6	6.8	94.9	12.0	11.5	0.9
C13	88.1	81.4	6.7	6.5	0.4	92.8	95.0	95.8	6.9	96.2	10.5	10.5	0.8
C14	85.9	79.7	6.1	6.3	0.4	90.5	93.9	94.6	6.0	95.3	9.5	9.5	0.7
C15	86.2	79.0	7.2	6.5	0.4	90.9	92.9	93.6	6.7	93.9	12.5	12.5	0.6
Avg.	87.0	79.8	7.1	6.6	0.4	91.7	93.8	94.5	6.6	95.1	12.1	12.0	0.7
Std Dv	0.8	0.9	0.7	0.2	0.0	0.8	0.7	0.8	0.3	0.8	2.2	2.1	0.1
90% CI	0.7	0.7	0.6	0.2	0.0	0.7	0.6	0.6	0.3	0.6	1.8	1.7	0.1
500 FT. FLYOVER -- TARGET IAS 110KTS.													
D16	86.0	78.1	7.9	6.7	0.4	90.4	91.9	92.9	6.4	92.6	15.5	14.5	1.1
D17	86.0	78.4	7.6	6.8	0.4	90.6	92.6	93.3	6.5	93.2	13.0	13.0	0.7
D18	86.1	78.6	7.5	6.7	0.4	90.6	92.6	93.4	6.4	93.6	13.0	13.0	0.8
Avg.	86.0	78.4	7.7	6.7	0.4	90.5	92.3	93.2	6.5	93.1	13.8	13.5	0.9
Std Dv	0.0	0.2	0.2	0.1	0.0	0.1	0.4	0.2	0.1	0.5	1.4	0.9	0.2
90% CI	0.0	0.4	0.4	0.2	0.0	0.2	0.7	0.4	0.1	0.8	2.4	1.5	0.3
500 FT. FLYOVER -- TARGET IAS 96KTS.													
E19	85.0	76.7	8.3	6.9	0.4	89.6	91.0	92.0	6.5	89.9	16.0	15.0	1.0
Avg.	85.0	76.7	8.3	6.9	0.4	89.6	91.0	92.0	6.5	89.9	16.0	15.0	1.0
Std Dv	-	-	-	-	-	-	-	-	-	-	-	-	-
90% CI	-	-	-	-	-	-	-	-	-	-	-	-	-

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

TABLE NO. A.5-5.5

BELL 222 HELICOPTER

SUMMARY NOISE LEVEL DATA

AS MEASURED *

DOT/TSC
8/18/83

SITE: 5 CENTERLINE - 188 M. EAST JUNE 15,1983

EV	SEL	AL*	SEL-AL*	K(A)	Q	EPNL	PNL*	PNLT*	K(P)	OASPL*	DUR(A)	DUR(P)	TC
1000 FT. FLYOVER -- TARGET IAS 123KTS.													
A1	82.4	72.2	10.2	7.3	0.4	86.5	85.1	87.0	6.9	87.6	25.0	24.0	0.9
A2	81.8	71.1	10.6	7.1	0.4	85.7	84.3	85.2	7.3	86.3	31.5	27.5	1.0
A3	81.4	71.1	10.3	7.3	0.4	85.5	85.1	86.1	6.8	86.8	26.5	25.0	1.0
A4	81.1	70.7	10.4	7.1	0.4	84.9	84.1	85.2	7.0	86.2	28.5	25.5	1.0
A5	82.2	72.1	10.1	6.9	0.3	86.0	85.8	86.6	6.5	86.6	29.5	28.0	0.9
A6	83.0	73.2	9.8	7.1	0.4	87.2	86.6	87.6	7.0	88.5	23.5	23.5	1.0
Avg.	82.0	71.7	10.2	7.1	0.4	86.0	85.3	86.3	6.9	87.0	27.4	25.6	1.0
Std Dv	0.7	0.9	0.3	0.2	0.0	0.8	1.0	1.0	0.3	0.9	3.0	1.8	0.1
90% CI	0.6	0.8	0.2	0.1	0.0	0.6	0.8	0.8	0.2	0.7	2.4	1.5	0.0
APPROACH -- MULTI-SEG. 1													
Q20		----------		NO DATA		----------							
Q21	93.3	88.2	5.0	6.2	0.5	99.0	103.4	104.2	6.1	103.1	6.5	6.0	0.8
Avg.	93.3	88.2	5.0	6.2	0.5	99.0	103.4	104.2	6.1	103.1	6.5	6.0	0.8
Std Dv	-	-	-	-	-	-	-	-	-	-	-	-	-
90% CI	-	-	-	-	-	-	-	-	-	-	-	-	-
APPROACH -- MULTI-SEG. 2													
R22	95.9	91.7	4.2	5.7	0.5	101.5	106.9	107.6	5.6	105.5	5.5	5.0	0.7
Avg.	95.9	91.7	4.2	5.7	0.5	101.5	106.9	107.6	5.6	105.5	5.5	5.0	0.7
Std Dv	-	-	-	-	-	-	-	-	-	-	-	-	-
90% CI	-	-	-	-	-	-	-	-	-	-	-	-	-
APPROACH -- MULTI-SEG. 3													
S23	100.8	95.6	5.2	6.1	0.5	105.5	109.9	110.6	5.8	107.1	7.0	7.0	0.7
Avg.	100.8	95.6	5.2	6.1	0.5	105.5	109.9	110.6	5.8	107.1	7.0	7.0	0.7
Std Dv	-	-	-	-	-	-	-	-	-	-	-	-	-
90% CI	-	-	-	-	-	-	-	-	-	-	-	-	-

* - NOISE INDEXES CALCULATED USING MEASURED DATA UNCORRECTED
FOR TEMPERATURE,HUMIDITY,OR AIRCRAFT DEVIATION FROM REF FLIGHT TRACK

APPENDIX B

Magnetic Recording Acoustical Data
for Flight Operations on June 16

On the third day of testing, an FAA mobile magnetic tape recording system was deployed at a single measurement. The data acquisition is described in Section 5.6.3.

EPNL, SEL, and ancillary indexes were calculated according to FAR-36 procedure using "As Measured" data, i.e., noise data uncorrected for temperature, humidity or aircraft deviations from reference flight track. The data reduction is further described in Section 6.3.

This Appendix contain "As Measured" noise level data for the June 16, 1983 tests of the Bell 222 at one microphone during approach and level flyover operations. The magnetic recording acoustical data for June 14 and 15, conducted by TSC rather than FAA, are presented in Appendix A.

Each table within this appendix contains the following information:

EV	The event, the test run number
SEL	Sound Exposure Level, expressed in decibels
AL_M	Maximum A-weighted Sound Level, expressed in decibles
EPNL	Effective Perceived Noise Level
PNL_M	Maximum Perceived Noise Level
$PNLT_M$	Maximum Tone Corrected Perceived Noise Level
OASPL	Maximum Overall Sound Level
DUR(A)	10 dB-down Duration of AL time history
DUR(P)	10 dB-down Duration of PNLT time history
TC	Tone Correction calculated at $PNLT_M$

TABLE B.1
BELL 222 HELICOPTER
SUMMARY NOISE LEVEL DATA
AS MEASURED*
SIDELINE - 150M SOUTH

APPROACHES

EV	SEL	LA_M	EPNL	PNL_M	$PNLT_M$	OASPL	DUR(A)	DUR(P)	TC
Q26	88.8	81.2	93.5	94.6	96.0	89.5	14.5	14.0	1.4
Q27	89.7	81.9	94.3	95.4	97.0	90.6	14.5	12.5	1.6
Q28	89.9	80.0	94.6	93.9	95.0	89.9	20.0	19.0	1.1
Q29	86.7	77.6	90.9	91.0	92.0	87.9	18.5	19.0	1.0
Q30	89.4	81.0	93.6	94.3	95.1	90.3	14.5	15.5	0.9
Q31	90.5	81.0	95.1	94.6	95.4	90.4	20.0	19.0	0.8
Q32	87.7	79.3	92.4	93.3	94.5	89.2	19.5	17.5	1.1
Q33	90.8	82.2	95.4	95.6	96.4	91.4	16.5	16.0	0.8
Q34	89.9	81.5	94.4	95.4	96.3	91.5	14.5	13.0	1.0
Q35	89.9	81.5	94.6	95.2	96.3	91.1	14.5	13.5	1.2
Q36	88.1	78.2	92.4	91.8	93.1	87.7	20.0	20.5	1.5
Q37	90.7	82.0	95.3	96.0	96.8	92.8	18.0	16.5	0.8
Q38	89.5	81.3	93.8	94.7	96.3	90.8	17.5	16.0	1.7
Q39	89.4	81.8	93.9	95.1	96.2	90.2	14.0	13.0	1.1
Q40	-	77.7	-	91.5	92.9	87.5	-	-	1.4
Q41	89.5	80.7	94.2	94.3	95.7	90.5	16.5	14.0	1.7

*Noise indexes calculated using measured data uncorrected for temperature, humidity, or aircraft deviation from ref flight track.

TABLE B.2
BELL 222 HELICOPTER
SUMMARY NOISE LEVEL DATA
AS MEASURED*
SIDELINE - 150M SOUTH

LEVEL FLYOVERS

EV	SEL	LA_M	EPNL	PNL_M	$PNLT_M$	OASPL	DUR(A)	DUR(P)	TC
G 42	86.8	77.5	91.9	92.8	93.4	92.3	17.0	16.0	0.7
G 43	85.8	77.7	91.2	90.8	91.7	89.5	16.0	21.5	0.9
G 44	85.7	76.5	90.4	90.2	91.5	89.8	15.5	16.5	1.3
H 45	84.4	75.1	88.9	88.4	89.2	87.0	17.5	19.5	0.9
H 46	84.4	74.8	88.9	88.2	88.8	86.6	22.0	22.0	0.6
H 47	84.2	75.1	88.4	87.7	88.5	85.5	18.0	19.5	0.8
I 48	82.5	73.0	86.1	85.1	85.9	83.8	19.0	20.0	0.9
I 49.	82.7	72.8	86.6	85.6	86.3	83.2	21.0	21.5	0.7

*Noise indexes calculated using measured data uncorrected for temperature, humidity, or aircraft deviation from ref flight track.

APPENDIX C

Direct Read Acoustical Data and Duration Factors for Flight Operations

In addition to the magnetic recording systems, four direct-read, Type-1 noise measurement systems were deployed at selected sites during flight operations. The data acquisition is described in Section 5.6.2.

These direct read systems collected single event data consisting of maximum A-weighted sound level (AL), Sound Exposure Level (SEL), integration time (T), and equivalent sound level (LEQ). The SEL and dBA, as well as the integration time were put into a computer data file and analyzed to determine two figures of merit related to the event duration influence on the SEL energy dose metric. The data reduction is further described in Section 6.2.2; the analysis of these data is discussed in Section 9.4.

This appendix presents direct read data and contains the results of the helicopter noise duration effect analysis for flight operations. The direct read acoustical data for static operations is presented in Appendix E.

Each table within this appendix provides the following information:

Run No.	The test run number
SEL(dB)	Sound Exposure Level, expressed in decibels
AL(dB)	A-Weighted Sound Level, expressed in decibels
T(10-dB)	Integration time
K(A)	Propagation constant describing the change in dBA with distance
Q	Time History "shape factor"
Average	The average of the column
N	Sample size
Std Dev	Standard Deviation
90% C.I.	Ninety percent confidence interval
Mic Site	The centerline mircophone site at which the measurements were taken

HELICOPTER: BELL 222 TABLE C.1

TEST DATE: 6-15-83

OPERATION: 1000 FT FLYOVER(0.9*VNE)/TARGET IAS=123 KTS

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
A1	82	72.1	25	7.1	.4
A2	81.5	70.8	27	7.5	.4
A3	82.1	71.4	27	7.5	.4
A4	81.3	71.1	25	7.3	.4
A5	82	71	30	7.4	.4
A6	83	72.6	24	7.5	.5
AVERAGE	82.00	71.50	26.30	7.40	.4
N	6	6	6	6	6
STD.DEV.	0.59	0.70	2.16	.17	.02
90% C.I.	0.49	0.58	1.78	.14	.02

HELICOPTER: BELL 222 TABLE C.2

TEST DATE: 6-15-83

OPERATION: 500 FT FLYOVER(VNE)/TARGET IAS=137 KTS

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
B7	87.2	79.1	13	7.3	.5
B8	88.7	81.6	11	6.8	.5
B9	88.8	81.2	12	7	.5
AVERAGE	88.20	80.60	12.00	7.00	.5
N	3	3	3	3	3
STD.DEV.	0.90	1.34	1.00	.23	.02
90% C.I.	1.51	2.26	1.69	.38	.03

HELICOPTER: BELL 222 TABLE C.3

TEST DATE: 6-15-83

OPERATION: 500 FT FLYOVER(0.9*VNE)/TARGET IAS=123 KTS

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
C10	87.1	79.4	13	6.9	.5
C11	87.1	79.3	14	6.8	.4
C12	87.7	79.7	15	6.8	.4
C13	87.8	80.9	13	6.2	.4
C14	86.6	79.3	12	6.8	.4
AVERAGE	87.30	79.70	13.40	6.70	.4
N	5	5	5	5	5
STD.DEV.	0.49	0.68	1.14	.29	.03
90% C.I.	0.47	0.65	1.09	.27	.03

HELICOPTER: BELL 222 TABLE C.4

TEST DATE: 6-15-83

OPERATION: 500 FT FLYOVER(0.8*VNE)/TARGET IAS=110 KTS

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
D16	86	78.5	13	6.7	.4
D17	85.8	78.4	12	6.9	.5
D18	86	78.1	10	7.9	.6
AVERAGE	85.90	78.30	11.70	7.20	.5
N	3	3	3	3	3
STD.DEV.	0.12	0.21	1.53	.64	.1
90% C.I.	0.19	0.35	2.58	1.08	.17

HELICOPTER: BELL 222 TABLE C.5

TEST DATE: 6-15-83

OPERATION: 500 FT FLYOVER(0.7*VNE)/TARGET IAS=96 KTS

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
E19	86.1	79.2	12	6.4	.4
AVERAGE	86.10	79.20	12.00	6.40	.4
N	1	1	1	1	1
STD.DEV.	ERROR	ERROR	ERROR	ERROR	ERROR
90% C.I.	ERROR	ERROR	ERROR	ERROR	ERROR

HELICOPTER: BELL 222 TABLE C.6.1

TEST DATE: 6-16-83

OPERATION: 700 FT FLYOVER(VNE)/TARGET IAS=137 KTS

MIC SITE: 5

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
642	84.4	75.8	16	7.1	.5
643	85.5	76.7	15	7.5	.5
644	85.2	76	16	7.6	.5
AVERAGE	85.00	76.20	15.70	7.40	.5
N	3	3	3	3	3
STD.DEV.	0.57	0.47	0.58	.25	.04
90% C.I.	0.96	0.80	0.97	.43	.06

HELICOPTER: BELL 222 TABLE C.6.2

TEST DATE: 6-16-83

OPERATION: 700 FT FLYOVER(VNE)/TARGET IAS=137 KTS

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
642	87.1	79.3	13	7	.5
643	86.7	77.9	12	8.2	.6
644	87.3	78.5	16	7.3	.5
AVERAGE	87.00	78.60	13.70	7.50	.5
N	3	3	3	3	3
STD.DEV.	0.31	0.70	2.08	.6	.09
90% C.I.	0.52	1.18	3.51	1.01	.16

HELICOPTER: BELL 222 TABLE C.6.3

TEST DATE: 6-16-83

OPERATION: 700 FT FLYOVER(VNE)/TARGET IAS=137 KTS

MIC SITE: 4

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
642	86.6	77.6	14	7.9	.6
643	85.8	76.9	16	7.4	.5
644	86	77.4	13	7.7	.6
AVERAGE	86.10	77.30	14.30	7.70	.5
N	3	3	3	3	3
STD.DEV.	0.42	0.36	1.53	.24	.04
90% C.I.	0.70	0.61	2.58	.4	.07

HELICOPTER: BELL 222 TABLE C.7.1

TEST DATE: 6-16-83

OPERATION: 700 FT FLYOVER(0.9*VNE)/TARGET IAS=123 KTS

MIC SITE: 5

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
H45	83.7	74.6	19	7.1	.4
H46	84.3	74	23	7.6	.5
H47	84	74.6	18	7.5	.5
AVERAGE	84.00	74.40	20.00	7.40	.5
N	3	3	3	3	3
STD.DEV.	0.30	0.35	2.65	.24	.03
90% C.I.	0.51	0.58	4.46	.4	.05

HELICOPTER: BELL 222 TABLE C.7.2

TEST DATE: 6-16-83

OPERATION: 700 FT FLYOVER(0.9*VNE)/TARGET IAS=123 KTS

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
H45	85.6	76.6	19	7	.4
H46	84.9	75.7	19	7.2	.4
H47	86.4	76.3	19	7.9	.5
AVERAGE	85.60	76.20	19.00	7.40	.5
N	3	3	3	3	3
STD.DEV.	0.75	0.46	0.00	.46	.06
90% C.I.	1.27	0.77	0.00	.77	.11

HELICOPTER: BELL 222 TABLE C.7.3

TEST DATE: 6-16-83

OPERATION: 700 FT FLYOVER(0.9*VNE)/TARGET IAS=123KTS

MIC SITE: 4

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
H45	84.1	74.4	18	7.7	.5
H46	84.5	75.4	18	7.2	.5
H47	84.3	74.5	17	8	.6
AVERAGE	84.30	74.80	17.70	7.60	.5
N	3	3	3	3	3
STD.DEV.	0.20	0.55	0.58	.36	.06
90% C.I.	0.34	0.93	0.97	.61	.09

HELICOPTER: BELL 222 TABLE C.8.1

TEST DATE: 6-16-83

OPERATION: 700 FT FLYOVER(0.8*VNE)/TARGET IAS=110 KTS

MIC SITE: 5

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
I48	81.8	71.7	22	7.5	.5
I49	82.8	73.7	18	7.2	.5
AVERAGE	82.30	72.70	20.00	7.40	.5
N	2	2	2	2	2
STD.DEV.	0.71	1.41	2.83	.19	.01
90% C.I.	3.16	6.32	12.64	.87	.04

HELICOPTER: BELL 222 TABLE C.8.2

TEST DATE: 6-16-83

OPERATION: 700 FT FLYOVER(0.8*VNE)/TARGET IAS=110 KTS

MIC SITE: 4

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
I48	82.6	72.7	21	7.5	.5
I49	82.7	72.8	24	7.2	.4
AVERAGE	82.70	72.80	22.50	7.30	.4
N	2	2	2	2	2
STD.DEV.	0.07	0.07	2.12	.22	.04
90% C.I.	0.32	0.32	9.48	.99	.19

HELICOPTER: BELL 222 TABLE C.9.1

TEST DATE: 6-14-83

OPERATION: ICAO TAKEOFF

MIC SITE: 5

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
K20	84.4	75.4	18	7.2	.4
K21	85.7	76.8	18	7.1	.4
K22	84.3	74.4	19	7.7	.5
K23	85.1	76.2	17	7.2	.5
K24	84.8	74.6	21	7.7	.5
K25	84.3	74.8	17	7.7	.5
AVERAGE	84.80	75.40	18.30	7.40	.5
N	6	6	6	6	6
STD.DEV.	0.56	0.96	1.51	.31	.04
90% C.I.	0.46	0.79	1.24	.26	.03

HELICOPTER: BELL 222 TABLE C.9.2

TEST DATE: 6-14-83

OPERATION: ICAO TAKEOFF

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
K20	83.6	73.3	23	7.6	.5
K21	84.1	73.8	21	7.8	.5
K22	83.3	72.8	23	7.7	.5
K23	83.2	74.1	20	7	.4
K24	83.5	73	24	7.6	.5
K25	83.1	72.7	24	7.5	.5
AVERAGE	83.50	73.30	22.50	7.50	.5
N	6	6	6	6	6
STD.DEV.	0.36	0.56	1.64	.28	.03
90% C.I.	0.30	0.46	1.35	.23	.03

HELICOPTER: BELL 222 TABLE C.10.1

TEST DATE: 6-14-83

OPERATION: 6 DEGREE ICAO APPROACH/TARGET IAS=65 KTS

MIC SITE: 5

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
L1	94.3	87.3	10	7	.5
L2	95.5	88.7	11	6.5	.4
L3	94.5	87.1	11	7.1	.5
L4	96	89.9	8	6.8	.5
L5	95.3	87.8	10	7.5	.6
L6	94.9	88.5	10	6.4	.4
AVERAGE	95.10	88.20	10.00	6.90	.5
N	6	6	6	6	6
STD.DEV.	0.64	1.04	1.10	.4	.05
90% C.I.	0.53	0.86	0.90	.33	.04

HELICOPTER: BELL 222 TABLE C.10.2

TEST DATE: 6-14-83

OPERATION: 6 DEGREE ICAO APPROACH/TARGET IAS=65 KTS

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
L1	92.4	83.7	14	7.6	.5
L2	93.7	85.7	12	7.4	.5
L3	93.7	85.9	11	7.5	.5
L4	93.2	85.7	11	7.2	.5
L5	93.5	85.7	11	7.5	.5
L6	94.2	86.3	12	7.3	.5
AVERAGE	93.50	85.50	11.80	7.40	.5
N	6	6	6	6	6
STD.DEV.	0.61	0.91	1.17	.14	.02
90% C.I.	0.50	0.75	0.96	.11	.01

HELICOPTER: BELL 222 TABLE C.11.1

TEST DATE: 6-14-83

OPERATION: 6 DEGREE APPROACH/TARGET IAS=45 KTS

MIC SITE: 5

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
M7	87.5	80.1	24	5.4	.2
M8	90.3	81.9	16	7	.4
M9	89.3	80.2	20	7	.4
AVERAGE	89.00	80.70	20.00	6.40	.4
N	3	3	3	3	3
STD.DEV.	1.42	1.01	4.00	.94	.11
90% C.I.	2.39	1.71	6.74	1.58	.19

HELICOPTEP: BELL 222 TABLE C.11.2

TEST DATE: 6-14-83

OPERATION: 6 DEGREE APPROACH/TARGET IAS=45 KTS

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
M7	91.5	83.6	17	6.4	.4
M8	87.1	78.3	19	6.9	.4
M9	89	79.7	20	7.1	.4
AVERAGE	89.20	80.50	18.70	6.80	.4
N	3	3	3	3	3
STD.DEV.	2.21	2.75	1.53	.37	.03
90% C.I.	3.72	4.63	2.58	.62	.05

HELICOPTER: BELL 222 TABLE C.12.1

TEST DATE: 6-14-83

OPERATION: 6 DEGREE APPROACH/TARGET IAS=55 KTS

MIC SITE: 5

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
N10	94.6	86.5	13	7.3	.5
N11	92.4	84.5	13	7.1	.5
N12	92.7	84.5	16	6.8	.4
N13	93.1	85.3	14	6.8	.4
AVERAGE	93.20	85.20	14.00	7.00	.5
N	4	4	4	4	4
STD.DEV.	0.98	0.95	1.41	.23	.04
90% C.I.	1.15	1.11	1.66	.27	.05

HELICOPTER: BELL 222 TABLE C.12.2

TEST DATE: 6-14-83

OPERATION: 6 DEGREE APPROACH/TARGET IAS=55 KTS

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
N10	91.9	83.7	14	7.2	.5
N11	90.6	81.8	15	7.5	.5
N12	93.5	87.1	12	5.9	.4
N13	92.4	83.7	15	7.4	.5
AVERAGE	92.10	84.10	14.00	7.00	.5
N	4	4	4	4	4
STD.DEV.	1.20	2.21	1.41	.72	.06
90% C.I.	1.42	2.60	1.66	.85	.08

HELICOPTER: BELL 222 TABLE C.13.1

TEST DATE: 6-14-83

OPERATION: 6 DEGREE APPROACH/TARGET IAS=75 KTS

MIC SITE: 5

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
014	93.1	85.6	11	7.2	.5
015	93	85.5	11	7.2	.5
016	93	86	10	7	.5
AVERAGE	93.00	85.70	10.70	7.10	.5
N	3	3	3	3	3
STD.DEV.	0.06	0.26	0.58	.12	.01
90% C.I.	0.10	0.45	0.97	.2	.01

TABLE C.13.2

HELICOPTER: BELL 222

TEST DATE: 6-14-83

OPERATION: 6 DEGREE APPROACH/TARGET IAS=75 KTS

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
014	92	83.7	13	7.5	.5
015	91.5	83.3	13	7.4	.5
016	92	83.7	13	7.5	.5
AVERAGE	91.80	83.60	13.00	7.40	.5
N	3	3	3	3	3
STD.DEV.	0.29	0.23	0.00	.05	.01
90% C.I.	0.49	0.39	0.00	.09	.01

TABLE C.14.1

HELICOPTER: BELL 222

TEST DATE: 6-14-83

OPERATION: 6 DEGREE APPROACH/TARGET IAS=85 KTS

MIC SITE: 5

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
P17	91.7	85.7	9	6.3	.4
P18	90.6	84.2	11	6.1	.4
P19	91.3	84.2	10	7.1	.5
AVERAGE	91.20	84.70	10.00	6.50	.5
N	3	3	3	3	3
STD.DEV.	0.56	0.87	1.00	.51	.06
90% C.I.	0.94	1.46	1.69	.87	.1

HELICOPTER: BELL 222 TABLE C.14.2

TEST DATE: 6-14-83

OPERATION: 6 DEGREE APPROACH/TARGET IAS=85 KTS

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
P17	89.7	81.8	12	7.3	.5
P18	90.2	81.9	12	7.7	.6
P19	90.5	83.2	12	6.8	.4
AVERAGE	90.10	82.30	12.00	7.30	.5
N	3	3	3	3	3
STD.DEV.	0.40	0.78	0.00	.47	.06
90% C.I.	0.68	1.32	0.00	.79	.1

HELICOPTER: BELL 222 TABLE C.15.1

TEST DATE: 6-15-83

OPERATION: EXPERIMENTAL MULTI SEGMENT APPROACH

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
Q20	94.9	89.4	6	7.1	.6
Q21	92.3	86.4	8	6.5	.5
AVERAGE	93.60	87.90	7.00	6.80	.5
N	2	2	2	2	2
STD.DEV.	1.84	2.12	1.41	.38	.07
90% C.I.	8.21	9.48	6.32	1.69	.33

HELICOPTER: BELL 222 TABLE C.15.2

TEST DATE: 6-15-83

OPERATION: EXPERIMENTAL MULTI SEGMENT APPROACH

MIC SITE: 4

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
020	101	94.8	7	7.3	.6
021	98.6	92.4	9	6.5	.5
AVERAGE	99.80	93.60	8.00	6.90	.5
N	2	2	2	2	2
STD.DEV.	1.70	1.70	1.41	.59	.1
90% C.I.	7.58	7.58	6.32	2.65	.44

HELICOPTER: BELL 222 TABLE C.16.1

TEST DATE: 6-16-83

OPERATION: EXPERIMENTAL MULTI SEGMENT APPROACH

MIC SITE: 5

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
024	84.5	74.4	12	9.4	.9
025	86.5	76.4	19	7.9	.5
026	86.7	77.3	16	7.8	.5
027	87.5	78.5	17	7.3	.5
028	88.3	79.3	18	7.2	.4
029	85.9	77.4	16	7.1	.4
030	85.9	75.3	20	8.1	.6
031	90	81.8	14	7.2	.5
032	84.4	76.4	19	6.3	.3
AVERAGE	86.60	77.40	16.80	7.60	.5
N	9	9	9	9	9
STD.DEV.	1.79	2.22	2.59	.87	.14
90% C.I.	1.11	1.38	1.60	.54	.09

HELICOPTER: BELL 222 TABLE C. 16.2

TEST DATE: 6-16-83

OPERATION: EXPERIMENTAL MULTI SEGMENT APPROACH

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
024	95.4	88.5	9	7.2	.5
025	95.5	89.9	7	6.6	.5
026	91.8	85.3	8	7.2	.6
027	91	84.1	10	6.9	.5
028	90.2	81.9	15	7.1	.5
029	92.5	87.4	6	6.6	.5
030	91.1	84.5	9	6.9	.5
031	88.4	79.6	17	7.2	.4
032	88.5	80.5	15	6.8	.4
AVERAGE	91.60	84.60	10.70	6.90	.5
N	9	9	9	9	9
STD.DEV.	2.57	3.55	3.97	.24	.05
90% C.I.	1.59	2.20	2.46	.15	.03

HELICOPTER: BELL 222 TABLE C.16.3

TEST DATE: 6-16-83

OPERATION: EXPERIMENTAL MULTI SEGMENT APPROACH

MIC SITE: 4

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
024	85	74.8	16	8.5	.7
025	89.6	80.8	13	7.9	.6
026	89.9	82.3	16	6.3	.4
027	89.9	81.6	17	6.7	.4
028	90.2	81.2	17	7.3	.5
029	87.8	79.8	15	6.8	.4
030	90.5	81.9	23	6.3	.3
031	90.7	81.1	26	6.8	.4
032	88.5	78.7	18	7.8	.5
AVERAGE	89.10	80.20	17.90	7.20	.5
N	9	9	9	9	9
STD.DEV.	1.81	2.32	4.08	.76	.11
90% C.I.	1.12	1.44	2.53	.47	.07

HELICOPTER: BELL 222 TABLE C.17.1

TEST DATE: 6-16-83

OPERATION: EXPERIMENTAL MULTI SEGMENT APPROACH

MIC SITE: 5

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
033	88.9	81	16	6.6	.4
034	88.4	78.1	23	7.6	.5
035	88.6	80.5	16	6.7	.4
036	86.9	77.2	28	6.7	.3
037	89.3	79.7	19	7.5	.5
038	87.8	79.7	16	6.7	.4
039	87.6	79.1	17	6.9	.4
040	85.8	76.1	24	7	.4
041	87.3	78.1	21	7	.4
AVERAGE	87.80	78.80	20.00	7.00	.4
N	9	9	9	9	9
STD.DEV.	1.09	1.59	4.30	.35	.04
90% C.I.	0.68	0.99	2.67	.22	.03

HELICOPTER: BELL 222 TABLE C.17.2

TEST DATE: 6-16-83

OPERATION: EXPERIMENTAL MULTI SEGMENT APPROACH

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
033	88.7	79	16	8.1	.6
034	89.8	80.9	15	7.6	.5
035	89.8	81.4	13	7.5	.5
036	89.3	80.5	15	7.5	.5
037	89.4	80.6	16	7.3	.5
038	91.1	83.8	10	7.3	.5
039	91.3	83.7	11	7.3	.5
040	90	81.6	15	7.1	.5
041	89	80.6	14	7.3	.5
AVERAGE	89.80	81.30	13.90	7.40	.5
N	9	9	9	9	9
STD.DEV.	0.88	1.55	2.15	.27	.04
90% C.I.	0.55	0.96	1.33	.16	.02

HELICOPTER: BELL 222 TABLE C.17.3

TEST DATE: 6-16-83

OPERATION: EXPERIMENTAL MULTI SEGMENT APPROACH

MIC SITE: 4

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
Q33	89.9	81	16	7.4	.5
Q34	90	81.4	14	7.5	.5
Q35	90.3	82.2	18	6.5	.4
Q36	87.7	78.6	18	7.2	.5
Q37	88.8	79.9	18	7.1	.4
Q38	88.2	79.3	16	7.4	.5
Q39	88.8	79.6	20	7.1	.4
Q40	88.9	79.8	14	7.9	.6
Q41	89.4	80.9	20	6.5	.4
AVERAGE	89.10	80.30	17.10	7.20	.5
N	9	9	9	9	9
STD.DEV.	0.86	1.14	2.26	.47	.07
90% C.I.	0.54	0.71	1.40	.29	.05

HELICOPTER: BELL 222 TABLE C.18

TEST DATE: 6-15-83

OPERATION: EXPERIMENTAL MULTI SEGMENT APPROACH

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
R22	92.2	85	10	7.2	.5
AVERAGE	92.20	85.00	10.00	7.20	.5
N	1	1	1	1	1
STD.DEV.	ERROR	ERROR	ERROR	ERROR	ERROR
90% C.I.	ERROR	ERROR	ERROR	ERROR	ERROR

HELICOPTER: BELL 222 TABLE C.19.1

TEST DATE: 6-15-83

OPERATION: EXPERIMENTAL MULTI SEGMENT APPROACH

MIC SITE: 5

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
S23	101.4	96.2	7	6.2	.5
AVERAGE	101.40	96.20	7.00	6.20	.5
N	1	1	1	1	1
STD.DEV.	ERROR	ERROR	ERROR	ERROR	ERROR
90% C.I.	ERROR	ERROR	ERROR	ERROR	ERROR

HELICOPTER: BELL 222 TABLE C.19.2

TEST DATE: 6-15-83

OPERATION: EXPERIMENTAL MULTI SEGMENT APPROACH

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
S23	96.7	89.5	10	7.2	.5
AVERAGE	96.70	89.50	10.00	7.20	.5
N	1	1	1	1	1
STD.DEV.	ERROR	ERROR	ERROR	ERROR	ERROR
90% C.I.	ERROR	ERROR	ERROR	ERROR	ERROR

TABLE C.20.1

HELICOPTER: BELL 222

TEST DATE: 6-14-83

OPERATION: 12 DEGREE APPROACH/TARGET IAS=45 KTS

MIC SITE: 5

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
T26	100.9	91.6	18	7.4	.5
T27	97.2	88.5	11	8.4	.7
T28	97.4	87.7	12	9	.8
T29	100.5	91.5	11	8.6	.7
AVERAGE	99.00	89.80	13.00	8.30	.7
N	4	4	4	4	4
STD.DEV.	1.97	2.02	3.37	.68	.13
90% C.I.	2.32	2.38	3.96	.8	.16

TABLE C.20.2

HELICOPTER: BELL 222

TEST DATE: 6-14-83

OPERATION: 12 DEGREE APPROACH/TARGET IAS=45 KTS

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
T26	94.6	85.6	15	7.7	.5
T27	94.3	86.6	11	7.4	.5
T28	92.8	86	13	6.1	.4
T29	94.2	85.4	20	6.8	.4
AVERAGE	94.00	85.90	14.80	7.00	.5
N	4	4	4	4	4
STD.DEV.	0.80	0.53	3.86	.69	.09
90% C.I.	0.94	0.62	4.54	.81	.11

HELICOPTER: BELL 222 TABLE C.21.1

TEST DATE: 6-14-83

OPERATION: 12 DEGREE APPROACH/TARGET IAS=55 KTS

MIC SITE: 5

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
U30	93.4	87.5	8	6.5	.5
U31	92.8	86.6	8	6.9	.5
U32	92.3	85.1	11	6.9	.5
AVERAGE	92.80	86.40	9.00	6.80	.5
N	3	3	3	3	3
STD.DEV.	0.55	1.21	1.73	.21	.02
90% C.I.	0.93	2.04	2.92	.35	.04

HELICOPTER: BELL 222 TABLE C.21.2

TEST DATE: 6-14-83

OPERATION: 12 DEGREE APPROACH/TARGET IAS=55 KTS

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
U30	88.8	80.5	17	6.7	.4
U31	90.5	80.8	18	7.7	.5
U32	90.7	83.4	12	6.8	.4
AVERAGE	90.00	81.60	15.70	7.10	.5
N	3	3	3	3	3
STD.DEV.	1.04	1.59	3.21	.56	.06
90% C.I.	1.76	2.69	5.42	.95	.1

HELICOPTER: BELL 222 TABLE C.22.1

TEST DATE: 6-14-83

OPERATION: 12 DEGREE APPROACH/TARGET IAS=65 KTS

MIC SITE: 5

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
V33	90.3	83.4	8	7.6	.6
V34	89.5	82.3	12	6.7	.4
V35	90.8	83.6	10	7.3	.5
AVERAGE	90.20	83.10	10.00	7.20	.5
N	3	3	3	3	3
STD.DEV.	0.66	0.70	2.00	.49	.09
90% C.I.	1.11	1.18	3.37	.82	.15

HELICOPTER: BELL 222 TABLE C.22.2

TEST DATE: 6-14-83

OPERATION: 12 DEGREE APPROACH/TARGET IAS=65 KTS

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
V33	88.2	80.6	12	7	.5
V34	88.3	80.5	12	7.2	.5
V35	89.5	82	13	6.7	.4
AVERAGE	88.70	81.00	12.30	7.00	.5
N	3	3	3	3	3
STD.DEV.	0.72	0.84	0.58	.25	.04
90% C.I.	1.22	1.41	0.97	.42	.06

HELICOPTER: BELL 222 TABLE C.23.1

TEST DATE: 6-14-83

OPERATION: 12 DEGREE APPROACH/TARGET IAS=70 KTS

MIC SITE: 5

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
W36	85.7	63.7	9	2.3	.2
W37	90.3	83.9	9	6.7	.5
W38	90.5	84.6	8	6.5	.5
W39	69.9	83.7	8	6.9	.5
W40	90.1	84.3	7	6.9	.5
AVERAGE	90.10	84.00	8.20	6.60	.5
N	5	5	5	5	5
STD.DEV.	0.38	0.40	0.84	.33	.05
90% C.I.	0.37	0.38	0.80	.31	.04

HELICOPTER: BELL 222 TABLE C.23.2

TEST DATE: 6-14-83

OPERATION: 12 DEGREE APPROACH/TARGET IAS=70 KTS

MIC SITE: 1

RUN NO.	SEL(DB)	AL(DB)	T(10-DB)	K(A)	Q
W36	88.1	79.7	14	7.3	.5
W37	88.5	80.5	12	7.4	.5
W38	88.3	80.5	12	7.2	.5
W39	87.4	79.7	13	6.4	.4
W40	87.6	79.7	15	6.7	.4
AVERAGE	88.00	80.00	13.80	7.00	.5
N	5	5	5	5	5
STD.DEV.	0.47	0.44	1.79	.44	.07
90% C.I.	0.44	0.42	1.71	.42	.06

APPENDI

Magnetic Recording Acoustical Data for Static Operations

This appendix contains time average, A-weighted sound level data along with time average, one-third octave sound pressure level information for eight different directivity emission angles. These data were acquired June 14 using the TSC magnetic recording system discussed in Section 5.6.1.

Thirty-two seconds of corrected raw spectral data (64 contiguous 1/2 second data records) have been energy averaged to produce the data tabulated in this appendix. The spectral data presented are "As Measured" for the given emission angles established relative to each microphone location. Also included in the tables are the 360 degree (eight emission angle) average levels, calculated by both arithmetic and energy averaging. The data reduction is further described in Section 6.1. Figure 6.1 (previously shown) provides the reader with a quick reference to the emission angle convention.

The data contained in these tables have been used in analyses presented in Sections 9.2 and 9.8. The reader may cross reference the magnetic recording data of this appendix with direct read static data presented in Appendix E.

Appendix D

Static Tests - "As Measured" 1/3 Octave Noise Data are presented.

The key to the table numbering system is as follows:

Table No. D. 1-1H. 1

Appendix No. → D.

Helicopter No. & Microphone Location → 1-1H.

Page No. of Group → 1

Table No.	D.1-X.X	Aerospatiale	SA-365N (Dauphin)
	D.2-X.X	Aerospatiale	SA-355F (Twinstar)
	D.3-X.X	Aerospatiale	AS-350D (Astar)
	D.4-X.X	Sikorsky	S-76 (Spirit)
	D.5-X.X	Bell	222
	D.6-X.X	Hughes	500D
	D.7-X.X	Boeing Vertol	CH-470D (Chinook)

Microphone No.	1H	(soft)	150 m northwest
	2	(soft)	150 m west
	4H	(soft)	300 m west
	5H	(hard)	150 m north

Page No.	1	Hover-in-Ground-Effect
	2	Flight Idle
	3	Ground Idle
	4	Hover-Out-of-Ground-Effect

TABLE NO. D.5-1H.1

BELL 222 HELICOPTER

DOT/TSC
9/ 7/83

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED***

SITE: 1H (SOFT) - 150 M. NW JUNE 14,1983

HOVER-IN-GROUND-EFFECT

BAND NO.*	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES) 0	45	90	135	180	225	270	315	Lav(360 DEGREE) ENERGY	ARITH**	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal										
14	82.5	74.9	74.9	81.3	77.2	76.1	79.9	83.3	79.9	78.8	3.4
15	76.5	77.7	77.6	77.8	77.1	77.4	77.3	72.7	77.0	76.8	1.7
16	75.8	74.5	74.2	74.2	73.5	73.9	74.2	76.3	74.7	74.6	1.0
17	77.2	76.8	76.3	76.0	75.5	76.0	76.0	77.4	76.4	76.4	0.7
18	78.1	77.8	77.8	83.8	77.6	78.0	76.5	78.2	79.1	78.5	2.2
19	66.9	66.5	67.4	69.6	64.9	68.7	67.7	69.1	67.8	67.6	1.5
20	65.4	66.0	65.6	66.0	64.7	65.6	64.7	67.2	65.7	65.6	0.8
21	69.5	69.7	67.4	75.8	74.9	74.9	72.2	72.9	73.0	72.2	3.0
22	61.3	64.3	63.6	65.0	61.9	65.0	64.1	63.8	63.8	63.6	1.4
23	63.8	66.1	61.8	66.2	64.5	65.4	63.8	62.7	64.5	64.3	1.6
24	51.2	55.3	51.1	56.3	49.5	55.6	54.6	53.4	53.9	53.4	2.5
25	30.3	43.3	41.1	45.7	37.0	43.8	44.3	41.4	42.7	41.9	3.0
26	37.3	43.6	43.6	44.1	38.1	42.6	43.7	43.2	42.6	42.0	2.7
27	42.8	47.0	46.4	46.0	43.0	45.7	47.2	46.9	45.9	45.6	1.8
28	45.3	48.1	47.5	49.3	44.3	46.3	46.0	48.8	47.3	46.9	1.8
29	45.9	49.8	49.2	49.8	45.3	46.7	46.6	49.9	48.3	47.9	2.0
30	45.7	49.1	49.8	49.7	45.3	46.5	45.7	50.5	48.3	47.8	2.2
31	46.4	47.3	50.4	48.6	46.1	47.7	46.5	50.8	48.4	48.0	1.8
32	46.4	46.9	49.4	48.0	46.8	47.2	45.4	52.1	48.3	47.8	2.1
33	47.5	47.1	50.1	48.3	47.5	47.6	45.7	52.2	48.7	48.2	2.0
34	45.8	45.0	48.7	46.6	45.8	46.5	45.9	50.8	47.3	46.9	1.9
35	48.3	45.8	48.2	45.9	45.5	46.7	46.1	53.2	48.3	47.5	2.6
36	46.7	45.1	45.1	43.8	44.9	45.1	44.6	48.3	45.7	45.4	1.4
37	45.1	44.7	45.8	42.9	45.1	44.5	43.7	47.8	45.2	44.9	1.5
38	49.5	45.5	44.8	43.6	44.4	43.9	44.7	49.2	46.3	45.7	2.3
39	46.6	43.6	44.3	42.8	45.3	44.3	43.9	43.7	44.5	44.3	1.2
40	42.2	41.7	41.5	-	42.1	41.3	41.3	43.3	42.0	41.9	0.7
AL	61.6	62.2	62.0	64.7	62.6	63.3	61.8	64.2	62.9	62.8	1.2
OASPL	86.0	84.0	83.7	87.5	84.2	84.4	84.7	86.4	85.3	85.1	1.4
PNL	77.9	78.1	78.1	82.1	79.1	79.8	78.0	80.1	79.[illegible]	79.1	1.5
PNLT	79.2	79.2	79.1	84.0	81.0	81.4	79.3	81.3	80.[illegible]	80.6	1.7

* - 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz
** - ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - 32 SECOND AVERGING TIME

TABLE NO. D.5-1H.2

BELL 222 HELICOPTER

DOT/TSC
9/ 7/83

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED***

SITE: 1H (SOFT) - 150 M. NW JUNE 14,1983

FLIGHT IDLE

BAND NO.*	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES)								Lav(360 DEGREE)		
	0	45	90	135	180	225	270	315	ENERGY	ARITH**	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal										
14	-	71.3	79.3	78.8	79.1	79.1	79.6	79.7	78.7	78.1	3.0
15	-	76.4	76.5	75.8	75.7	75.4	76.1	75.9	76.0	76.0	0.4
16	-	73.5	74.0	72.8	73.0	72.9	73.9	73.6	73.4	73.4	0.5
17	-	75.3	76.3	74.8	74.6	74.6	76.0	75.9	75.4	75.4	0.7
18	-	74.9	75.9	75.6	78.9	76.4	76.1	75.6	76.4	76.2	1.3
19	-	65.6	69.3	66.2	66.9	66.9	69.4	67.7	67.6	67.4	1.5
20	-	64.7	66.5	63.1	64.1	63.6	65.8	65.1	64.8	64.7	1.2
21	-	72.4	67.8	71.5	75.7	68.2	66.5	64.7	71.0	69.5	3.8
22	-	59.9	60.5	59.1	62.0	58.8	60.9	59.8	60.3	60.1	1.1
23	-	63.0	64.4	60.3	66.5	61.2	63.9	61.7	63.5	63.0	2.1
24	-	49.6	55.6	54.3	54.3	51.8	53.4	52.5	53.4	53.1	2.0
25	-	37.3	42.7	41.4	42.5	39.0	42.2	41.7	41.3	41.0	2.0
26	-	36.0	39.8	38.1	39.3	36.7	41.4	38.6	38.9	38.6	1.8
27	-	35.6	40.7	39.5	39.7	39.7	41.9	40.3	39.9	39.6	2.0
28	-	42.2	42.2	39.4	40.2	42.3	42.9	41.5	41.7	41.5	1.3
29	-	43.0	41.5	37.4	39.8	43.1	42.4	42.3	41.7	41.4	2.1
30	-	43.6	42.0	37.3	39.6	42.6	42.0	42.4	41.7	41.4	2.2
31	-	43.7	41.7	37.7	39.5	42.4	41.8	42.3	41.7	41.3	2.0
32	-	44.9	41.1	37.8	38.3	42.0	40.7	41.7	41.5	40.9	2.4
33	-	45.3	40.7	36.9	37.9	42.5	40.9	42.1	41.7	40.9	2.8
34	-	44.7	38.9	35.9	36.6	40.6	39.1	40.5	40.4	39.5	2.9
35	-	44.7	38.5	35.7	35.8	40.0	38.5	40.1	40.1	39.0	3.1
36	-	42.8	36.0	-	-	38.1	36.5	38.1	39.1	38.3	2.7
37	-	42.5	34.5	-	-	36.4	35.1	37.0	38.2	37.1	3.2
38	-	42.8	34.8	-	-	37.6	35.9	37.7	38.8	37.8	3.1
39	-	41.4	32.9	-	-	34.9	33.5	35.9	37.0	35.7	3.4
40	-	39.1	32.0	-	-	33.3	32.4	34.1	35.1	34.2	2.9
AL	-	60.6	59.4	58.7	62.4	58.4	59.0	58.0	59.8	59.5	1.5
OASPL	-	82.4	84.2	83.5	84.7	83.5	84.1	83.9	83.8	83.8	0.7
PNL	-	76.7	74.5	74.2	77.7	74.3	74.5	74.0	75.5	75.1	1.5
PNLT	-	78.4	75.5	75.9	79.8	75.5	75.6	74.9	76.9	76.5	1.8

* - 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz
** - ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - 32 SECOND AVERGING TIME

TABLE NO. D.5-1H.3

BELL 222 HELICOPTER

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED***

DOT/TSC
9/ 7/83

SITE: 1H (SOFT) - 150 M. NW JUNE 14,1983

GROUND IDLE

BAND NO.*	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES)								Lav(360 DEGREE)		
	0	45	90	135	180	225	270	315	ENERGY	ARITH**	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal										
14	-	-	-	50.4	-	51.2	-	51.6	51.1	51.1	0.6
15	-	-	-	50.0	-	51.4	-	48.7	50.2	50.0	1.4
16	-	-	-	59.3	-	61.1	-	54.5	59.1	58.3	3.4
17	-	-	-	53.6	-	53.5	-	52.3	53.2	53.1	0.7
18	-	-	-	54.0	-	52.7	-	50.8	52.7	52.5	1.6
19	-	-	-	59.8	-	57.6	-	54.9	57.9	57.4	2.5
20	-	-	-	54.1	-	55.2	-	52.7	54.1	54.0	1.3
21	-	-	-	59.0	-	57.4	-	53.9	57.2	56.8	2.6
22	-	-	-	53.4	-	53.9	-	52.7	53.4	53.3	0.6
23	-	-	-	52.8	-	52.1	-	51.6	52.2	52.2	0.6
24	-	-	-	47.0	-	46.0	-	44.2	45.9	45.7	1.4
25	-	-	-	35.1	-	33.6	-	30.2	33.4	33.0	2.5
26	-	-	-	33.1	-	35.6	-	30.4	33.5	33.0	2.6
27	-	-	-	32.0	-	36.0	-	30.4	33.5	32.8	2.9
28	-	-	-	32.1	-	33.5	-	32.0	32.6	32.5	0.8
29	-	-	-	31.2	-	33.0	-	32.7	32.4	32.3	1.0
30	-	-	-	31.8	-	31.3	-	31.5	31.5	31.5	0.3
31	-	-	-	32.1	-	33.2	-	33.8	33.1	33.0	0.9
32	-	-	-	29.8	-	33.1	-	34.9	33.1	32.6	2.6
33	-	-	-	28.6	-	32.2	-	35.7	33.1	32.2	3.6
34	-	-	-	30.3	-	32.1	-	35.1	33.0	32.5	2.4
35	-	-	-	-	-	31.6	-	36.7	34.9	34.1	3.6
36	-	-	-	-	-	33.7	-	36.9	35.6	35.3	2.3
37	-	-	-	-	-	31.9	-	38.6	36.4	35.2	4.7
38	-	-	-	-	-	33.5	-	38.7	36.8	36.1	3.7
39	-	-	-	-	-	34.4	-	37.9	36.5	36.1	2.5
40	-	-	-	-	-	28.8	-	33.0	31.4	30.9	3.0
AL	-	-	-	48.9	-	49.1	-	49.5	49.5	49.2	0.3
OASPL	-	-	-	66.1	-	65.9	-	62.9	65.2	65.0	1.8
PNL	-	-	-	62.2	-	62.6	-	63.4	63.0	62.7	0.6
PNLT	-	-	-	63.2	-	63.2	-	63.9	63.8	63.4	0.4

* - 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz
** - ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - 32 SECOND AVERGING TIME

DOT/TSC
10/12/83

TABLE NO. D.5-1H.4

BELL 222 HELICOPTER

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED***

SITE: 1H (SOFT) - 150 M. NW JUNE 14,1983

HOVER-OUT-OF-GROUND-EFFECT

BAND NO.*	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES) 0	45	90	135	180	225	270	315	Lav(360 DEGREE) ENERGY	ARITH**	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal										
14	82.3	80.3	80.7	81.5	83.4	80.6	82.4	84.3	82.1	81.9	1.4
15	78.1	76.0	76.7	76.0	80.1	75.1	78.5	78.3	77.6	77.3	1.7
16	74.9	72.7	73.2	72.6	76.5	71.5	74.6	74.8	74.1	73.8	1.6
17	76.0	75.3	74.7	75.4	78.3	74.3	76.7	74.8	75.9	75.7	1.3
18	80.4	75.8	75.6	79.9	79.4	77.6	78.6	77.3	78.4	78.1	1.8
19	67.9	66.8	68.3	71.6	71.9	68.3	68.2	67.7	69.2	68.8	1.9
20	65.0	65.9	67.3	72.9	73.8	67.8	64.5	66.0	69.3	67.9	3.5
21	71.8	75.3	70.4	75.9	76.4	71.7	72.2	70.9	73.7	73.1	2.4
22	62.0	65.1	65.9	70.8	73.4	68.6	64.2	64.3	68.4	66.8	3.8
23	66.4	70.3	66.4	70.2	72.7	69.9	67.8	70.1	69.7	69.2	2.2
24	60.6	64.4	60.4	64.8	67.2	64.7	63.8	61.3	64.0	63.4	2.4
25	55.9	62.6	59.1	64.9	66.1	65.5	62.3	60.5	63.2	62.1	3.5
26	60.5	69.4	64.3	69.7	70.8	70.3	68.9	67.3	68.6	67.6	3.6
27	64.1	73.6	68.1	72.2	73.6	72.7	71.9	71.8	71.8	71.0	3.3
28	65.9	74.1	69.0	73.8	73.4	72.8	73.2	73.8	72.7	72.0	3.0
29	67.1	73.2	68.2	71.4	70.2	69.9	72.0	74.0	71.3	70.7	2.4
30	66.0	69.6	65.1	64.6	63.2	63.9	68.0	73.5	68.2	66.7	3.5
31	64.3	62.3	58.5	62.8	62.8	61.8	61.1	70.4	64.5	63.0	3.4
32	61.7	63.2	60.0	65.0	64.7	63.4	64.4	64.8	63.7	63.4	1.8
33	59.2	62.9	60.2	59.8	59.3	59.2	63.6	65.7	61.9	61.2	2.5
34	57.7	57.6	55.4	59.2	58.9	57.3	58.4	63.4	59.1	58.5	2.3
35	57.0	56.5	54.8	55.9	55.7	54.7	55.9	60.7	56.8	56.4	1.9
36	54.6	54.1	52.1	53.2	52.9	52.0	52.6	56.6	53.8	53.5	1.5
37	51.1	51.3	49.9	50.2	50.0	49.6	49.8	55.0	51.3	50.9	1.8
38	52.3	50.8	48.9	48.3	47.4	48.7	48.8	53.3	50.3	49.8	2.1
39	50.0	49.0	45.9	45.0	44.7	45.5	45.7	49.1	47.3	46.9	2.1
40	44.2	43.2	41.4	40.8	40.9	41.4	41.0	45.2	42.6	42.3	1.7
AL	73.4	78.4	73.8	77.4	77.4	76.6	77.4	79.9	77.2	76.8	2.2
OASPL	86.7	85.9	85.0	87.0	88.6	85.6	87.1	87.8	86.9	86.7	1.2
PNL	85.3	89.0	85.2	89.0	89.3	87.8	88.2	89.8	88.5	87.9	1.8
PNLT	86.7	90.6	86.1	90.3	90.5	88.9	89.5	91.1	89.4	89.2	1.9

* - 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz
** - ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - 32 SECOND AVERGING TIME

TABLE NO. D.5-2H.1

BELL 222 HELICOPTER

DOT/TSC
9/ 7/83

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED***

SITE: 2 (SOFT) - 150 M. WEST JUNE 14,1983

HOVER-IN-GROUND-EFFECT

BAND NO.*	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES)								Lav(360 DEGREE)		
	0	45	90	135	180	225	270	315	ENERGY	ARITH**	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal										
14	85.1	84.8	83.6	83.5	83.8	83.9	83.6	82.5	83.9	83.8	0.8
15	81.7	81.3	80.9	81.1	80.8	81.3	81.1	81.0	81.2	81.1	0.3
16	79.1	78.2	77.5	77.7	77.3	77.9	78.0	78.3	78.0	78.0	0.6
17	80.4	79.1	79.3	79.5	79.2	79.4	79.9	80.0	79.6	79.6	0.5
18	80.6	79.5	80.2	82.5	82.9	83.7	81.2	80.2	81.6	81.3	1.5
19	73.0	71.6	73.4	73.5	71.8	72.9	72.8	72.8	72.8	72.7	0.7
20	71.2	70.4	71.1	71.1	70.2	70.5	71.6	70.4	70.8	70.8	0.5
21	74.3	72.9	77.1	76.5	77.6	77.9	71.8	74.0	75.8	75.3	2.3
22	66.4	67.1	69.9	70.0	67.9	68.6	68.1	71.0	68.9	68.6	1.6
23	69.1	67.6	71.7	70.7	72.0	70.0	68.2	77.3	72.0	70.8	3.0
24	58.5	59.7	64.0	64.7	61.1	61.8	60.8	67.7	63.3	62.3	3.0
25	48.8	48.3	51.6	53.0	50.3	51.7	49.2	55.1	51.6	51.0	2.3
26	44.1	42.3	44.6	44.7	43.2	44.0	43.0	45.6	44.1	43.9	1.1
27	44.9	46.6	46.5	44.8	43.4	44.9	45.3	47.1	45.6	45.4	1.2
28	46.3	47.9	48.8	46.4	44.8	47.3	47.7	50.5	47.8	47.5	1.7
29	46.0	47.5	48.3	46.2	44.3	45.9	47.5	50.3	47.3	47.0	1.8
30	46.7	48.1	48.6	46.4	44.7	45.2	48.5	50.7	47.8	47.4	2.0
31	46.4	48.5	48.2	45.7	44.9	45.4	47.6	50.4	47.5	47.1	1.9
32	46.3	48.9	47.9	45.3	44.1	44.0	46.1	49.7	47.0	46.5	2.1
33	46.3	48.2	48.0	45.6	43.9	43.7	45.9	48.9	46.7	46.3	1.9
34	44.9	46.8	47.2	44.3	42.1	41.8	44.5	47.2	45.3	44.8	2.1
35	46.0	48.7	46.9	44.3	41.7	41.1	44.0	47.0	45.6	45.0	2.7
36	44.2	45.4	44.9	43.1	40.6	39.5	41.9	45.0	43.5	43.1	2.2
37	42.6	43.6	43.1	41.6	38.9	37.3	40.3	43.4	41.8	41.3	2.3
38	44.8	44.2	44.3	43.4	40.0	38.7	40.5	44.9	43.1	42.6	2.5
39	42.6	41.5	41.6	41.8	38.9	36.9	38.9	43.1	41.1	40.7	2.2
40	38.9	37.9	38.2	38.2	35.1	32.4	35.0	38.9	37.3	36.8	2.4
AL	64.5	64.1	66.6	66.2	66.3	66.2	64.1	69.0	66.2	65.9	1.6
OASPL	89.3	88.6	88.5	88.9	89.0	89.4	88.5	88.5	88.9	88.8	0.4
PNL	80.6	80.1	82.6	82.2	81.9	82.3	80.6	84.7	81.7	81.9	1.5
PNLT	81.7	81.0	83.7	83.2	83.3	83.7	81.4	86.0	82.7	83.0	1.6

* - 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz
** - ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - 32 SECOND AVERGING TIME

TABLE NO. D.5-2H.2

BELL 222 HELICOPTER

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED***

DOT/TSC
9/ 7/83

SITE: 2 (SOFT) - 150 M. WEST JUNE 14,1983

FLIGHT IDLE

BAND NO.*	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES) 0	45	90	135	180	225	270	315	Lav(360 DEGREE) ENERGY	ARITH**	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal										
14	82.3	81.9	81.6	81.5	81.6	81.8	81.8	81.8	81.8	81.8	0.2
15	79.9	79.1	79.7	79.1	78.9	79.0	79.5	79.4	79.3	79.3	0.4
16	77.0	76.6	77.0	76.6	76.6	76.9	77.2	77.0	76.9	76.9	0.2
17	78.5	77.7	78.6	78.2	78.1	78.7	78.8	78.4	78.4	78.4	0.4
18	79.5	78.1	77.3	78.4	80.5	78.5	77.3	77.9	78.6	78.4	1.1
19	70.4	69.9	72.2	69.3	69.7	70.3	72.1	70.4	70.7	70.5	1.1
20	67.6	67.2	70.1	66.8	67.7	68.1	70.4	67.7	68.4	68.2	1.3
21	71.1	72.6	69.3	74.3	76.0	71.8	68.8	64.5	72.2	71.0	3.6
22	61.6	64.6	62.7	64.7	64.2	62.2	64.9	6[illegible].2	63.6	63.4	1.3
23	65.2	69.7	68.4	68.5	70.2	65.4	68.8	6[illegible].3	68.3	67.9	1.8
24	56.3	59.4	59.4	60.7	57.6	58.5	60.0	5[illegible].0	59.0	58.9	1.4
25	43.6	47.4	47.0	47.8	46.1	47.2	48.9	4[illegible].6	47.2	46.9	1.6
26	36.2	39.5	39.4	41.4	38.9	40.2	39.8	40.2	39.7	39.4	1.5
27	36.5	40.2	39.7	41.4	39.8	41.1	40.4	40.7	40.2	40.0	1.5
28	39.5	43.7	42.4	43.6	41.9	43.2	42.9	43.1	42.7	42.5	1.4
29	39.8	43.7	41.6	42.4	42.6	41.9	42.8	44.5	42.6	42.4	1.4
30	41.3	45.0	42.6	43.0	43.8	42.8	43.4	44.5	43.4	43.3	1.2
31	42.4	44.9	42.1	43.2	44.1	42.7	43.9	44.4	43.6	43.5	1.0
32	42.3	44.0	41.3	42.6	43.4	42.0	42.8	43.2	42.8	42.7	0.9
33	42.4	43.3	41.0	41.9	43.1	41.7	41.8	42.4	42.3	42.2	0.8
34	41.0	41.6	39.4	41.0	42.1	39.7	40.0	40.6	40.8	40.7	0.9
35	40.1	41.0	38.7	39.7	41.2	38.4	37.9	39.5	39.7	39.6	1.2
36	38.2	38.8	35.7	37.0	39.0	35.9	34.8	-	37.3	37.1	1.7
37	37.0	37.5	33.5	34.9	36.9	33.3	-	-	35.8	35.5	1.9
38	37.0	37.9	33.8	35.4	37.2	34.1	-	-	36.2	35.9	1.7
39	35.5	36.5	30.6	31.3	34.2	29.8	-	-	33.7	33.0	2.8
40	32.0	33.6	27.7	28.3	30.7	26.6	-	-	30.5	29.8	2.7
AL	61.2	63.1	61.9	63.2	64.4	61.4	62.4	61.1	62.5	62.3	1.2
OASPL	87.1	86.5	86.6	86.6	87.1	86.6	86.7	86.5	86.7	86.7	0.2
PNL	77.3	78.1	76.8	78.4	79.7	76.8	77.3	76.6	77.4	77.6	1.1
PNLT	78.4	79.4	78.1	79.8	81.4	77.9	78.3	77.7	78.6	78.9	1.3

* - 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz
** - ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - 32 SECOND AVERGING TIME

TABLE NO. D.5-2H.3

BELL 222 HELICOPTER

DOT/TSC
9/ 7/83

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED***

SITE: 2 (SOFT) - 150 M. WEST JUNE 14,1983

GROUND IDLE

BAND NO.*	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES) 0	45	90	135	180	225	270	315	Lav(360 DEGREE) ENERGY	ARITH**	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal										
14	54.1	-	54.4	-	53.8	-	55.3	-	54.4	54.4	0.6
15	50.7	-	52.4	-	50.2	-	51.3	-	51.2	51.1	0.9
16	64.2	-	61.9	-	66.1	-	56.3	-	63.4	62.1	4.2
17	53.9	-	53.5	-	56.2	-	56.8	-	55.3	55.1	1.6
18	51.7	-	53.0	-	52.2	-	52.6	-	52.4	52.4	0.6
19	56.8	-	62.7	-	58.1	-	56.7	-	59.4	58.6	2.8
20	52.9	-	55.7	-	57.2	-	59.8	-	57.1	56.4	2.9
21	53.6	-	63.6	-	55.1	-	56.4	-	59.1	57.2	4.4
22	52.8	-	59.0	-	56.7	-	57.8	-	57.1	56.6	2.7
23	53.2	-	56.3	-	55.8	-	56.3	-	55.6	55.4	1.5
24	47.3	-	51.0	-	50.6	-	51.3	-	50.3	50.1	1.9
25	39.8	-	42.6	-	39.1	-	40.9	-	40.8	40.6	1.5
26	32.6	-	35.0	-	31.7	-	31.6	-	33.0	32.7	1.6
27	39.3	-	33.0	-	31.3	-	31.4	-	35.2	33.7	3.8
28	36.0	-	41.4	-	32.4	-	32.7	-	37.3	35.6	4.2
29	35.2	-	33.3	-	32.5	-	33.2	-	33.7	33.5	1.2
30	33.2	-	32.4	-	32.0	-	32.9	-	32.6	32.6	0.5
31	34.5	-	29.4	-	32.2	-	32.0	-	32.4	32.0	2.1
32	36.9	-	29.4	-	31.7	-	30.5	-	33.2	32.1	3.3
33	38.0	-	30.9	-	30.3	-	-	-	34.6	33.1	4.3
34	38.1	-	29.4	-	30.5	-	-	-	34.5	32.7	4.7
35	37.2	-	-	-	29.6	-	-	-	34.9	33.4	5.4
36	37.6	-	-	-	-	-	-	-	37.6	37.6	-
37	38.2	-	-	-	-	-	-	-	38.2	38.2	-
38	37.9	-	-	-	-	-	-	-	37.9	37.9	-
39	35.0	-	-	-	-	-	-	-	35.0	35.0	-
40	30.4	-	-	-	-	-	-	-	30.4	30.4	-
AL	50.7	-	52.8	-	50.3	-	50.9	-	51.8	51.2	1.1
OASPL	66.8	-	69.2	-	68.7	-	66.6	-	68.0	67.8	1.3
PNL	64.4	-	66.0	-	63.3	-	63.1	-	65.5	64.2	1.3
PNLT	66.1	-	68.7	-	63.9	-	63.7	-	66.4	65.6	2.3

* - 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz
** - ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - 32 SECOND AVERGING TIME

DOT/TSC
9/ 7/83

TABLE NO. D.5-2H.4

BELL 222 HELICOPTER

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED***

SITE: 2 (SOFT) - 150 M. WEST JUNE 14,1983

HOVER-OUT-OF-GROUND-EFFECT

BAND NO.*	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES)								Lav(360 DEGREE)		
	0	45	90	135	180	225	270	315	ENERGY	ARITH**	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal										
14	84.7	83.6	82.8	81.3	83.6	82.8	81.8	76.0	82.6	82.1	2.7
15	81.0	79.6	79.4	79.3	80.2	79.7	79.4	74.2	79.4	79.1	2.1
16	77.9	75.7	76.0	76.0	76.7	76.2	76.1	71.3	76.0	75.7	1.9
17	79.1	75.9	77.8	78.2	77.0	77.4	77.7	73.3	77.3	77.0	1.8
18	81.0	79.7	76.9	78.4	80.5	79.2	77.4	74.2	78.9	78.4	2.2
19	70.5	67.7	70.7	75.0	74.7	71.3	70.6	65.0	71.7	70.7	3.3
20	68.1	65.0	67.7	74.8	75.2	69.9	68.4	61.4	70.8	68.8	4.6
21	77.1	72.5	72.1	76.3	77.8	75.8	74.2	71.4	75.2	74.6	2.4
22	64.4	63.5	70.8	75.7	74.6	70.8	67.8	62.7	71.1	68.8	5.0
23	71.9	67.8	71.3	74.8	74.3	71.0	68.6	67.8	71.7	70.9	2.7
24	64.9	62.5	67.5	70.0	68.5	65.5	61.9	64.2	66.4	65.6	2.9
25	58.6	57.6	61.5	64.9	63.1	59.9	55.6	57.2	60.8	59.8	3.2
26	63.1	63.1	66.5	69.5	66.9	64.0	61.2	59.5	65.3	64.2	3.3
27	68.1	69.0	71.1	74.1	71.5	69.5	65.6	64.9	70.1	69.2	3.1
28	70.1	71.6	72.0	74.3	72.7	71.0	67.2	67.3	71.4	70.8	2.5
29	68.5	70.1	69.4	70.4	69.1	69.8	65.6	72.9	69.9	69.5	2.0
30	65.8	66.8	64.2	61.5	62.9	64.7	60.7	71.1	66.2	65.1	3.0
31	61.0	61.5	59.1	61.7	61.2	58.7	56.6	67.9	62.3	61.0	3.3
32	63.4	63.6	63.3	64.5	64.6	63.4	60.0	62.0	63.3	63.1	1.5
33	62.4	63.8	59.5	59.5	58.6	60.9	56.8	61.2	60.8	60.3	2.2
34	59.0	58.7	57.8	58.8	59.6	58.2	56.9	59.8	58.7	58.6	1.0
35	56.7	58.3	54.9	55.4	55.6	56.3	53.9	57.6	56.3	56.1	1.4
36	52.7	53.5	52.6	52.6	52.8	53.8	51.0	54.7	53.1	53.0	1.1
37	49.2	51.8	49.0	49.4	49.2	50.2	48.0	52.0	50.1	49.8	1.4
38	48.6	49.9	48.1	48.3	46.2	48.5	46.7	52.0	48.9	48.5	1.8
39	46.8	45.2	45.2	44.7	43.2	45.8	44.3	50.2	46.2	45.7	2.1
40	41.0	39.8	39.6	39.3	37.4	40.7	38.7	44.1	40.5	40.1	2.0
AL	75.1	75.9	75.8	77.9	76.5	75.4	71.9	77.0	76.0	75.7	1.8
OASPL	89.1	87.6	87.4	88.2	88.9	87.8	86.7	83.2	87.7	87.4	1.9
PNL	87.3	87.3	87.5	89.8	88.9	87.4	84.4	87.4	87.8	87.5	1.6
PNLT	89.1	88.6	88.8	91.1	90.4	88.6	85.5	89.0	88.6	88.9	1.6

* - 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz
** - ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - 32 SECOND AVERGING TIME

TABLE NO. D.5-4H.1

BELL 222 HELICOPTER

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED***

DOT/TSC
9/ 7/83

SITE: 4H (SOFT) - 300 M. WEST JUNE 14,1983

HOVER-IN-GROUND-EFFECT

BAND NO.*	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES) 0	45	90	135	180	225	270	315	Lav(360 DEGREE) ENERGY	ARITH**	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal										
14	75.8	75.7	74.7	74.3	75.1	74.9	74.9	73.6	74.9	74.9	0.7
15	73.2	72.8	72.3	72.6	72.1	72.9	72.6	73.0	72.7	72.7	0.4
16	70.0	68.9	68.2	68.4	68.1	68.9	68.9	69.6	68.9	68.9	0.7
17	71.5	70.0	70.1	70.3	70.3	70.7	71.0	71.4	70.7	70.7	0.6
18	72.5	71.3	72.4	74.5	74.3	75.6	73.4	72.7	73.5	73.3	1.4
19	63.8	61.8	64.5	64.5	62.8	64.4	64.2	64.0	63.8	63.7	1.0
20	60.9	59.3	61.1	61.0	60.0	60.8	62.8	60.7	60.9	60.8	1.0
21	66.4	65.1	68.5	68.2	69.1	71.2	64.4	66.5	67.9	67.4	2.2
22	54.5	54.6	58.6	58.2	55.8	58.7	57.9	61.0	57.9	57.4	2.3
23	55.7	52.5	58.0	55.9	57.5	58.1	56.3	65.9	59.5	57.5	3.8
24	44.9	40.2	44.7	45.4	45.3	46.4	45.0	52.2	46.8	45.5	3.3
25	42.7	37.5	40.7	37.3	39.7	42.1	40.6	44.6	41.3	40.6	2.5
26	41.1	38.4	38.2	37.5	35.1	39.6	38.4	42.9	39.5	38.9	2.4
27	40.8	46.2	43.3	39.1	36.5	39.8	38.2	44.0	42.1	41.0	3.3
28	40.3	40.8	39.0	36.4	37.0	41.0	38.9	42.4	39.9	39.5	2.1
29	40.2	37.6	37.7	35.3	35.8	40.0	39.0	41.3	38.8	38.4	2.1
30	40.0	35.7	37.1	34.7	35.7	37.7	39.6	40.8	38.2	37.7	2.3
31	38.2	35.9	36.0	33.9	34.8	35.7	38.9	39.5	37.0	36.6	2.0
32	37.3	35.4	35.7	33.4	33.4	34.4	38.0	39.2	36.3	35.8	2.1
33	36.0	34.2	35.2	32.1	32.6	33.2	37.1	38.0	35.3	34.8	2.1
34	33.5	32.1	34.1	-	-	30.0	35.8	35.6	33.9	33.5	2.2
35	34.1	32.3	33.7	-	-	-	33.9	34.5	33.8	33.8	0.7
36	-	-	-	-	-	-	-	-	-	-	-
37	-	-	-	-	-	-	-	-	-	-	-
38	-	-	-	-	-	-	-	-	-	-	-
39	-	-	-	-	-	-	-	-	-	-	-
40	-	-	-	-	-	-	-	-	-	-	-
AL	55.0	53.7	56.1	55.7	56.0	57.8	54.9	58.5	56.2	56.0	1.6
OASPL	80.4	79.7	79.7	80.1	80.2	81.0	80.0	79.9	80.1	80.1	0.4
PNL	69.9	68.3	71.0	70.3	70.5	72.5	70.0	73.0	71.1	70.7	1.5
PNLT	71.4	70.5	72.6	71.8	72.4	74.4	71.0	74.5	72.5	72.3	1.5

* - 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz
** - ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - 32 SECOND AVERGING TIME

TABLE NO. D.5-4H.2

BELL 222 HELICOPTER

DOT/TSC
9/ 7/83

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED***

SITE: 4H (SOFT) - 300 M. WEST JUNE 14,1983

FLIGHT IDLE

BAND NO.*	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES) 0	45	90	135	180	225	270	315	Lav(360 DEGREE) ENERGY	ARITH**	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal										
14	73.6	73.0	72.5	72.5	72.9	73.3	73.4	73.3	73.1	73.1	0.4
15	71.2	70.3	70.7	70.4	70.3	70.9	71.0	70.9	70.7	70.7	0.3
16	67.5	66.7	67.1	66.8	67.1	67.9	67.8	67.7	67.3	67.3	0.5
17	69.5	67.9	69.0	68.2	68.8	70.2	69.7	69.7	69.2	69.1	0.8
18	71.6	69.7	69.3	70.2	72.1	69.6	68.6	69.7	70.2	70.1	1.2
19	62.0	59.7	63.6	59.7	60.3	61.9	63.3	61.1	61.7	61.4	1.5
20	59.0	55.7	60.7	56.9	58.0	59.5	61.0	57.4	58.9	58.5	1.9
21	65.3	62.4	62.4	65.5	68.6	62.4	58.6	55.8	64.1	62.6	4.0
22	55.6	52.5	51.3	52.1	51.6	50.3	51.9	50.5	52.3	52.0	1.6
23	53.1	55.6	56.1	54.2	54.0	49.7	52.4	51.4	53.7	53.3	2.1
24	39.2	42.4	38.3	45.4	35.3	40.0	39.9	41.4	41.1	40.2	3.0
25	34.4	35.5	34.9	35.8	34.3	37.5	37.9	34.8	35.8	35.6	1.4
26	33.3	34.5	33.5	35.8	32.0	36.2	34.6	36.5	34.8	34.5	1.6
27	35.9	34.7	34.8	35.5	34.8	34.9	33.7	35.9	35.1	35.0	0.7
28	36.0	35.7	33.8	36.5	36.0	34.2	33.4	36.6	35.4	35.3	1.3
29	31.5	35.9	32.2	36.2	31.5	32.0	32.1	33.6	33.5	33.1	1.9
30	32.1	37.3	32.7	35.8	31.0	31.4	31.9	32.7	33.7	33.1	2.2
31	32.4	36.1	31.5	35.6	31.6	30.9	31.9	32.0	33.2	32.7	2.0
32	32.9	34.6	30.8	34.9	30.7	30.5	30.1	30.1	32.3	31.8	2.0
33	34.5	33.4	29.0	34.8	29.5	30.1	-	-	32.5	31.9	2.6
34	34.3	30.2	32.4	35.1	27.9	-	-	-	32.7	32.0	3.0
35	30.1	-	-	-	-	-	-	-	30.1	30.1	-
36	-	-	-	-	-	-	-	-	-	-	-
37	-	-	-	-	-	-	-	-	-	-	-
38	-	-	-	-	-	-	-	-	-	-	-
39	-	-	-	-	-	-	-	-	-	-	-
40	-	-	-	-	-	-	-	-	-	-	-
AL	53.2	51.9	52.1	53.1	54.5	51.1	50.5	49.7	52.3	52.0	1.6
OASPL	78.5	77.4	77.6	77.5	78.3	78.1	77.9	77.8	77.9	77.9	0.4
PNL	67.5	65.7	65.9	67.8	68.7	64.9	63.9	64.1	66.6	66.1	1.8
PNLT	68.8	67.1	67.8	69.7	71.0	66.2	64.9	65.0	68.0	67.6	2.2

* - 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz
** - ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - 32 SECOND AVERGING TIME

TABLE NO. D.5-4H.3

BELL 222 HELICOPTER

DOT/TSC
9/ 7/83

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED***

SITE: 4H (SOFT) - 300 M. WEST JUNE 14,1983

GROUND IDLE ****

BAND NO.*	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES) 0	45	90	135	180	225	270	315	Lav(360 DEGREE) ENERGY	ARITH**	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal										
14	49.5	-	49.3	-	48.5	-	49.6	-	49.2	49.2	0.5
15	47.7	-	49.7	-	47.6	-	47.3	-	48.2	48.1	1.1
16	59.0	-	56.9	-	59.8	-	52.4	-	57.8	57.0	3.3
17	50.2	-	52.7	-	51.5	-	50.6	-	51.4	51.2	1.1
18	49.9	-	52.3	-	49.3	-	48.5	-	50.2	50.0	1.6
19	54.8	-	57.2	-	53.4	-	53.1	-	54.9	54.6	1.9
20	49.8	-	52.9	-	52.0	-	53.4	-	52.2	52.0	1.6
21	47.5	-	55.6	-	48.1	-	50.3	-	51.7	50.4	3.7
22	45.1	-	50.4	-	47.1	-	48.0	-	48.1	47.6	2.2
23	39.6	-	43.6	-	41.5	-	42.6	-	42.1	41.8	1.7
24	31.7	-	34.6	-	32.9	-	34.1	-	33.5	33.3	1.3
25	27.9	-	29.0	-	27.6	-	27.7	-	28.1	28.0	0.6
26	31.2	-	32.0	-	29.8	-	27.4	-	30.4	30.1	2.0
27	36.8	-	30.1	-	29.8	-	29.5	-	32.8	31.6	3.5
28	33.5	-	31.3	-	30.3	-	30.7	-	31.6	31.4	1.4
29	29.4	-	27.8	-	28.9	-	28.2	-	28.6	28.6	0.7
30	31.6	-	27.0	-	27.7	-	27.5	-	28.9	28.4	2.1
31	27.9	-	26.5	-	26.9	-	27.5	-	27.2	27.2	0.6
32	27.4	-	26.1	-	26.9	-	26.7	-	26.8	26.8	0.5
33	28.5	-	27.0	-	26.7	-	26.1	-	27.2	27.1	1.0
34	28.8	-	31.1	-	27.9	-	27.2	-	29.0	28.7	1.7
35	27.6	-	26.9	-	27.3	-	29.0	-	27.8	27.7	0.9
36	29.9	-	28.4	-	29.4	-	26.3	-	28.7	28.5	1.6
37	28.6	-	28.0	-	25.7	-	24.5	-	27.0	26.7	1.9
38	26.2	-	26.2	-	25.5	-	24.0	-	25.6	25.5	1.0
39	28.2	-	26.0	-	32.7	-	31.6	-	30.4	29.6	3.1
40	19.9	-	19.4	-	25.1	-	23.6	-	22.7	22.0	2.8
AL	43.2	-	45.0	-	42.7	-	43.0	-	43.6	43.5	1.0
OASPL	62.2	-	63.5	-	62.6	-	60.5	-	62.3	62.2	1.3
PNL	56.0	-	58.3	-	55.5	-	55.5	-	56.2	56.3	1.3
PNLT	57.3	-	59.7	-	56.7	-	56.8	-	57.3	57.6	1.4

* - 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz
** - ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - 32 SECOND AVERGING TIME

****- TABULATED LEVELS ARE CONTAMINATED BY LOCAL AMBIENT

TABLE NO. D.5-4H.4

BELL 222 HELICOPTER

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED***

DOT/TSC
9/ 7/83

SITE: 4H (SOFT) - 300 M. WEST JUNE 14,1983

HOVER-OUT-OF-GROUND-EFFECT

BAND NO.*	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES) 0	45	90	135	180	225	270	315	Lav(360 DEGREE) ENERGY	ARITH**	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal										
14	75.2	74.9	74.2	72.9	-	73.7	73.3	72.2	73.9	73.8	1.1
15	72.1	72.1	70.8	71.4	-	71.3	71.7	71.4	71.6	71.5	0.5
16	68.0	67.0	66.5	67.2	-	66.8	67.3	67.6	67.2	67.2	0.5
17	69.2	67.5	68.9	69.2	-	68.2	68.9	69.5	68.8	68.8	0.7
18	72.3	71.9	69.7	70.7	-	70.4	69.6	70.9	70.9	70.8	1.0
19	60.0	58.4	61.8	65.1	-	60.9	61.6	61.0	61.7	61.3	2.0
20	56.8	54.2	58.4	64.8	-	59.0	58.8	57.5	59.7	58.5	3.2
21	67.9	62.[illegible]	62.9	66.6	-	67.3	65.5	68.7	66.4	65.8	2.5
22	53.0	[illegible]	60.8	65.3	-	61.4	59.2	58.3	60.5	58.6	4.7
23	61.8	58.7	63.6	66.8	-	62.1	60.7	62.6	63.0	62.3	2.5
24	58.7	57.8	63.0	65.1	-	60.6	57.0	62.3	61.5	60.6	3.0
25	55.8	56.0	60.1	61.7	-	57.1	54.0	58.0	58.2	57.5	2.7
26	55.7	56.0	59.5	60.4	-	54.6	52.4	57.6	57.3	56.6	2.8
27	58.3	58.6	60.3	63.0	-	57.6	54.1	59.3	59.4	58.7	2.7
28	59.8	61.3	62.2	64.9	-	59.4	56.0	59.8	61.2	60.5	2.7
29	60.3	61.7	63.1	65.4	-	62.0	57.5	61.3	62.2	61.6	2.4
30	60.4	61.8	62.6	64.5	-	61.8	57.8	61.4	61.9	61.5	2.1
31	60.8	61.2	60.0	62.1	-	60.9	57.1	60.4	60.6	60.3	1.6
32	60.5	60.0	57.0	57.6	-	58.5	55.7	58.9	58.6	58.3	1.7
33	57.8	54.0	51.1	51.2	-	53.8	52.8	[illegible]	54.6	53.9	2.0
34	54.3	48.9	48.6	52.4	-	47.4	49.9	53.3	51.4	50.7	2.6
35	51.6	50.8	49.4	51.1	-	48.4	47.4	49.5	50.0	49.7	1.5
36	48.5	45.7	44.6	44.7	-	46.5	44.7	47.7	46.3	46.1	1.6
37	43.9	41.0	37.5	40.4	-	41.1	41.4	44.5	42.0	41.7	1.8
38	42.9	37.8	36.2	36.1	-	35.6	38.1	41.4	39.2	38.4	2.7
39	33.2	-	-	-	-	-	31.0	36.8	36.3	35.3	3.8
40	28.8	-	-	-	-	-	-	26.7	27.9	27.7	1.5
AL	69.0	69.0	69.3	71.4	-	68.6	65.4	69.0	69.1	68.8	1.8
OASPL	80.0	79.3	79.0	79.9	-	78.9	78.5	79.0	79.3	79.2	0.5
PNL	80.9	79.7	79.4	81.7	-	79.5	77.3	80.5	80.2	79.9	1.4
PNLT	83.0	81.1	80.4	82.4	-	80.7	78.4	82.3	81.2	81.2	1.6

* - 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz
** - ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - 32 SECOND AVERGING TIME

TABLE NO. D.5-5H.1

BELL 222 HELICOPTER

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED***

DOT/TSC
9/ 8/83

SITE: 5H (HARD) - 150 M. NORTH JUNE 14,1983

HOVER-IN-GROUND-EFFECT

BAND NO.*	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES) 0	45	90	135	180	225	270	315	Lav(360 DEGREE) ENERGY	ARITH**	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal										
14	80.9	81.6	80.7	79.6	80.1	80.2	79.6	78.8	80.3	80.2	0.9
15	78.1	77.7	77.7	76.6	77.0	77.5	77.6	77.5	77.5	77.5	0.5
16	74.9	74.6	75.0	73.5	73.5	73.8	74.1	74.1	74.2	74.2	0.6
17	76.4	75.3	76.1	74.9	75.0	75.3	75.7	76.0	75.6	75.6	0.5
18	76.2	74.7	75.4	75.6	79.1	82.8	78.5	75.5	78.1	77.2	2.7
19	68.3	68.0	68.6	67.8	68.0	68.8	69.1	67.6	68.3	68.3	0.5
20	67.3	66.1	67.0	65.5	66.6	66.6	66.7	65.2	66.5	66.4	0.8
21	68.0	68.5	71.7	72.3	74.6	77.5	67.7	67.7	72.5	71.0	3.7
22	66.3	63.9	63.9	64.4	65.6	68.4	64.8	62.9	65.7	65.4	1.8
23	69.1	64.9	69.5	67.5	70.9	72.9	66.5	67.1	69.2	68.5	2.6
24	67.8	64.3	68.1	66.2	68.5	70.9	66.1	65.3	67.6	67.1	2.1
25	[illegible]	62.6	67.1	64.6	65.4	69.3	65.0	63.7	65.9	65.4	2.1
26	63.4	61.2	65.0	64.2	63.1	69.8	64.6	64.8	65.2	64.5	2.5
27	64.4	61.1	64.7	63.3	64.4	69.2	64.9	66.2	65.4	64.8	2.3
28	[illegible]	59.7	63.8	61.6	63.4	69.0	63.7	64.4	64.4	63.5	2.7
29	59.9	57.9	61.0	59.6	60.7	67.4	61.9	62.9	62.4	61.4	2.9
30	57.6	56.6	59.3	58.0	59.1	65.5	60.0	61.5	60.6	59.7	2.8
31	55.4	55.2	57.3	56.4	56.8	63.8	58.4	59.1	58.8	57.8	2.8
32	54.8	54.1	55.8	54.4	54.9	60.9	55.9	56.5	56.5	55.9	2.2
33	53.8	52.4	54.1	53.0	53.3	58.8	54.8	54.4	54.8	54.3	2.0
34	52.7	51.1	52.9	50.6	51.8	56.4	53.6	51.9	53.0	52.6	1.8
35	54.4	53.4	51.4	48.7	50.7	54.9	51.9	51.6	52.5	52.1	2.0
36	52.7	48.7	49.2	46.7	49.0	53.5	49.3	49.4	50.3	49.8	2.2
37	50.7	49.1	48.0	45.9	47.9	51.9	48.3	48.3	49.1	48.8	1.8
38	53.8	50.0	49.3	47.6	48.5	51.7	48.2	50.5	50.4	49.9	2.0
39	51.8	47.8	47.8	46.4	49.2	50.6	47.1	49.2	49.1	48.7	1.8
40	47.0	43.8	43.4	42.0	44.2	46.7	43.3	44.6	44.7	44.4	1.7
AL	70.0	67.7	70.7	69.1	70.4	75.4	70.4	70.9	71.2	70.6	2.2
OARPL	85.5	85.2	85.4	84.4	85.6	87.5	85.2	84.4	85.5	85.4	1.0
PNL	83.7	81.6	83.7	82.3	84.1	88.1	83.1	83.4	84.0	83.7	1.9
PNLT	84.1	82.8	84.5	83.5	85.5	89.9	84.2	84.0	85.1	84.8	2.2

* - 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz
** - ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - 32 SECOND AVERGING TIME

TABLE NO. D.5-5H.2

BELL 222 HELICOPTER

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED***

DOT/TSC
9/ 7/83

SITE: 5H (HARD) - 150 M. NORTH JUNE 14,1983

FLIGHT IDLE

BAND NO.*	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES)								Lav(360 DEGREE)		
	0	45	90	135	180	225	270	315	ENERGY	ARITH**	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal										
14	79.3	79.2	78.4	78.9	79.1	78.8	79.1	79.3	79.0	79.0	0.3
15	76.6	76.5	76.4	76.2	76.5	75.7	76.1	76.2	76.3	76.3	0.3
16	74.2	74.0	73.5	73.8	73.7	73.2	73.7	74.1	73.8	73.8	0.3
17	75.5	75.1	75.2	75.1	74.9	75.0	74.9	76.0	75.2	75.2	0.4
18	76.0	73.7	73.0	75.7	77.9	75.7	74.3	74.5	75.4	75.1	1.5
19	67.1	66.8	68.0	66.4	66.4	65.6	68.1	67.4	67.0	67.0	0.9
20	64.6	64.5	66.1	63.8	64.5	64.1	65.6	65.0	64.8	64.8	0.6
21	67.4	69.7	63.3	72.2	76.1	72.6	67.5	64.2	71.0	69.1	4.4
22	59.3	60.5	60.4	61.7	63.0	62.7	62.5	60.2	61.5	61.3	1.4
23	62.5	65.6	64.8	65.7	71.8	68.3	68.3	65.1	67.4	66.3	2.9
24	60.2	61.4	62.3	65.9	66.8	66.1	64.8	63.6	64.4	63.9	2.4
25	58.7	59.2	60.1	64.7	62.5	64.9	63.4	62.2	62.5	62.0	2.4
26	58.4	58.9	58.8	64.2	60.4	65.3	63.8	61.4	62.1	61.4	2.7
27	59.0	58.6	58.7	63.3	59.3	64.9	63.2	61.6	61.7	61.1	2.5
28	58.5	58.2	57.8	62.0	58.1	64.2	62.7	60.0	60.8	60.2	2.5
29	57.3	56.7	56.6	59.9	56.3	61.8	61.2	59.1	59.1	58.6	[illegible]
30	57.1	56.2	56.7	58.2	54.8	60.2	60.6	58.1	58.1	57.7	2.0
31	55.8	55.3	55.5	56.4	53.6	57.8	58.6	56.5	56.4	56.2	1.5
32	53.7	53.9	54.1	54.3	52.0	55.3	55.6	54.0	54.2	54.1	1.1
33	52.6	52.8	53.0	51.7	50.5	53.9	53.0	52.3	52.6	52.5	[illegible]
34	51.3	51.9	51.2	49.7	49.0	50.7	51.0	50.5	50.7	50.7	0.9
35	49.4	50.1	49.2	47.8	46.9	48.6	48.0	48.2	48.6	48.5	[illegible]
36	47.1	47.1	45.8	44.5	44.6	46.3	45.0	45.8	45.9	45.8	[illegible]
37	46.3	46.3	44.0	42.4	43.1	44.7	43.3	44.8	44.6	44.4	[illegible]
38	46.2	46.3	44.0	42.4	42.7	45.1	42.8	44.7	44.5	44.3	1.6
39	44.8	45.2	41.3	39.2	40.4	42.0	40.3	42.5	42.4	42.0	2.1
40	41.5	42.2	38.0	36.0	36.6	37.9	37.4	39.5	39.2	38.6	2.2
AL	66.4	66.5	66.3	69.0	68.0	70.4	69.5	67.6	68.2	68.0	1.6
OASPL	84.1	83.8	83.3	84.1	85.0	84.1	83.9	83.9	84.0	84.0	[illegible]
PNL	79.7	80.0	79.3	81.4	82.7	82.5	81.7	80.0	81.1	80.9	1.3
PNLT	80.6	81.2	79.8	83.0	84.8	84.0	82.4	80.6	82.4	82.0	1.8

* - 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz
** - ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - 32 SECOND AVERGING TIME

TABLE NO. D.5-5H.3

BELL 222 HELICOPTER

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED***

DOT/TSC
9/ 7/83

SITE: 5H (HARD) - 150 M. NORTH JUNE 14,1983

GROUND IDLE

BAND NO.*	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES) 0	45	90	135	180	225	270	315	Lav(360 DEGREE) ENERGY	ARITH**	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal										
14	52.2	-	55.2	-	50.6	-	49.4	-	52.4	51.8	2.5
15	48.6	-	51.1	-	49.2	-	48.5	-	49.5	49.3	1.2
16	59.9	-	54.6	-	63.7	-	60.5	-	60.7	59.7	3.8
17	52.5	-	52.3	-	53.3	-	53.5	-	52.9	52.9	0.6
18	49.7	-	50.2	-	53.2	-	51.9	-	51.5	51.2	1.6
19	53.8	-	53.5	-	55.9	-	58.0	-	55.7	55.3	2.1
20	51.5	-	51.6	-	52.9	-	56.2	-	53.5	53.0	2.2
21	50.5	-	54.3	-	53.0	-	58.4	-	55.0	54.0	3.3
22	49.8	-	54.8	-	51.4	-	59.2	-	55.3	53.8	4.2
23	51.8	-	56.4	-	53.2	-	59.1	-	56.0	55.1	3.3
24	52.5	-	57.2	-	55.0	-	59.4	-	56.7	56.0	3.0
25	53.8	-	57.8	-	54.5	-	59.1	-	56.9	56.3	2.6
26	52.4	-	55.1	-	53.0	-	58.9	-	55.7	54.8	2.9
27	54.9	-	55.2	-	53.0	-	59.2	-	56.2	55.6	2.6
28	51.8	-	52.5	-	50.[illegible]	-	56.7	-	53.5	52.8	2.7
29	51.1	-	49.2	-	48.0	-	54.2	-	51.3	50.6	2.7
30	50.1	-	47.4	-	43.5	-	53.1	-	50.0	49.1	3.3
31	49.0	-	[illegible]	-	46.3	-	53.8	-	50.1	49.1	3.4
32	47.9	-	46.6	-	46.0	-	50.6	-	48.1	47.7	2.1
33	49.9	-	46.5	-	43.4	-	48.7	-	47.8	47.1	2.9
34	49.0	-	4[illegible].9	-	42.7	-	46.4	-	46.9	46.2	3.0
35	47.4	-	43.4	-	40.9	-	46.1	-	45.1	44.4	2.9
36	46.6	-	43.7	-	41.1	-	45.5	-	44.7	44.2	2.4
37	47.4	-	41.1	-	42.0	-	45.4	-	44.8	44.2	2.6
38	47.2	-	42.9	-	43.7	-	46.6	-	45.5	45.1	2.1
39	46.0	-	44.3	-	43.6	-	47.4	-	45.6	45.3	1.7
40	40.8	-	39.3	-	37.9	-	40.9	-	39.9	39.7	1.4
AL	61.1	-	60.4	-	59.5	-	64.2	-	61.6	61.0	2.4
OASPL	66.1	-	66.8	-	67.4	-	70.0	-	67.8	67.6	1.7
PNL	74.1	-	72.7	-	70.8	-	76.3	-	73.9	73.5	2.3
PNLT	75.1	-	73.3	-	71.2	-	76.9	-	74.5	74.1	2.4

* - 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz
** - ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - 32 SECOND AVERGING TIME

TABLE NO. D.5-5H.4

BELL 222 HELICOPTER

1/3 OCTAVE NOISE DATA -- STATIC TESTS

AS MEASURED***

DOT/TSC
9/ 7/83

SITE: 5H (HARD) - 150 M. NORTH JUNE 14,1983

HOVER-OUT-OF-GROUND-EFFECT

BAND NO.*	LEVELS @ ACOUSTIC EMMISION ANGLES OF (DEGREES)								Lav(360 DEGREE)		
	0	45	90	135	180	225	270	315	ENERGY	ARITH**	Std Dv
	SOUND PRESSURE LEVEL dB re 20 microPascal										
14	83.2	84.3	83.6	82.6	84.9	84.9	81.9	81.1	83.5	83.3	1.4
15	80.6	79.1	79.9	77.9	82.6	79.3	79.2	77.4	79.8	79.5	1.6
16	77.3	76.5	77.0	74.4	79.2	76.3	76.2	74.7	76.7	76.4	1.5
17	79.2	78.0	78.5	76.0	80.9	79.2	78.6	77.8	78.7	78.5	1.4
18	81.9	78.5	80.4	82.1	82.7	83.5	78.7	78.2	81.2	80.7	2.1
19	71.2	70.2	71.4	70.7	72.9	75.3	73.0	70.6	72.2	71.9	1.7
20	69.6	69.6	69.6	68.1	74.0	76.8	73.4	69.4	72.3	71.3	3.0
21	76.4	76.3	79.1	77.2	78.0	80.6	76.8	77.6	78.0	77.7	1.5
22	68.9	70.8	71.4	69.5	76.0	79.1	76.2	71.5	74.4	72.9	3.7
23	74.9	75.2	75.4	73.8	77.6	80.1	77.9	76.6	76.9	76.4	2.0
24	72.1	73.6	75.0	71.6	75.2	76.8	73.7	74.0	74.3	74.0	1.7
25	69.8	71.1	72.8	68.6	68.6	68.8	67.0	69.7	69.9	69.6	1.8
26	67.8	68.1	70.2	62.7	67.3	68.1	64.7	67.4	67.5	67.0	2.3
27	64.7	64.9	64.8	65.2	74.6	74.6	73.0	65.2	70.7	68.4	4.7
28	69.5	63.6	67.1	70.9	77.3	78.9	76.3	72.0	74.4	71.9	5.3
29	73.5	65.3	71.3	72.1	72.9	76.7	73.9	74.8	73.4	72.6	3.4
30	73.5	66.4	71.3	69.9	67.6	70.0	67.9	74.5	71.0	70.1	2.9
31	70.2	65.8	68.2	63.1	68.0	69.1	66.7	70.2	68.2	67.7	2.4
32	65.4	63.2	62.4	64.2	66.2	68.4	66.5	65.5	65.6	65.2	1.9
33	66.7	62.1	64.6	61.3	64.0	65.0	63.2	65.8	64.4	64.1	1.8
34	62.8	60.2	61.3	59.7	61.4	63.1	61.2	61.9	61.6	61.4	1.2
35	61.4	60.7	59.7	57.4	59.9	61.1	60.1	60.3	60.2	60.1	1.2
36	60.8	56.2	57.0	55.2	57.5	58.7	57.9	57.7	57.9	57.6	1.7
37	56.5	55.5	54.1	53.0	55.1	55.6	55.1	55.0	55.1	55.0	1.0
38	57.6	55.0	53.3	52.8	53.7	54.3	54.1	54.4	54.6	54.4	1.5
39	56.6	51.4	50.3	50.1	51.9	51.6	51.0	52.9	52.5	52.0	2.1
40	50.5	47.2	45.6	45.6	47.7	47.3	46.7	47.5	47.5	47.3	1.5
AL	79.5	75.6	76.1	77.1	80.3	82.3	79.8	80.2	79.5	79.1	2.1
OASPL	89.2	88.5	89.2	88.1	91.0	91.4	88.8	87.9	89.4	89.3	1.3
PNL	91.5	89.2	90.4	89.0	92.7	94.3	91.9	91.4	91.6	91.3	1.8
PNLT	92.7	90.2	91.9	90.5	94.2	95.6	93.2	92.6	92.5	92.6	1.8

* - 14 TO 40 - STANDARD 1/3 OCTAVE BANDS 25 TO 10KHz
** - ARITHMETIC AVERAGE OF MEASURED LEVELS OVER 360 DEGREES
*** - 32 SECOND AVERGING TIME

APPENDIX E

Direct Read Acoustical Data for Static Operations

This appendix contains time averaged, A-weighted sound level data (Leq values) obtained using direct read Precision Integrating Sound Level meters. Data are presented for microphone locations 5H, 2, and 4 (see Figure 3.3).

A description of the measurement systems is provided in Section 5.6.2, and a figure of the typical PISLM system is shown in Figure 5.4. Data are shown in Table E-1, depicting the equivalent sound levels for eight different source emission angles. In each case the angle is indexed to the specific measurement site. A figure showing the emission angle convention is included in the text (Figure 6.1). In each case, the Leq (or time averaged AL) represents an average over a sample period of approximately 60 seconds.

Quantities appearing in this appendix include:

HIGE	Hover-in-ground-effect, skid height 5 feet above ground level
HOGE	Hover-out-of-ground-effect, skid height 30 feet above ground level
Flight Idle	Skids on ground
Ground Idle	Skids on ground

TABLE E.1

STATIC OPERATIONS

DIRECT READ DATA

(ALL VALUES A-WEIGHTED LEQ, EXPRESSED IN DECIBELS)

BELL 222

6-14-83

SITE 2 (SOFT SITE)

HIGE		HOGE		FLT. IDLE		GND. IDLE	
Y-0	81.7	Z-0	76	X-0A	61.5	X-0B	50.9
Y-315	83.3	Z-315	78	X-315A	61.1	X-270B	52.3
Y-270	82.8	Z-270	71.6	X-180A	62.4	X-180B	50.8
Y-225	85	Z-225	75.7	X-135A	64	X-90B	53.9
Y-180	84.2	Z-180	76.7	X-90A	62.4		
Y-135A	84.0	Z-135	77.9	X-45A	63.4		
Y-90A	85.4	Z-90	75.9				
Y-45	83	Z-45	76.3				

BELL 222

6-14-83

SITE 4H (SOFT SITE)

HIGE		HOGE		FLT.IDLE		GND. IDLE	
Y-0	71.1	Z-0	73.8	X-0A	69.3	X-0B	55.5
Y-315	72.2	Z-315	74.3	X-315A	67.9	X-270B	55.5
Y-270	71.3	Z-270	71.1	X-270A	68.2	X-180B	55.1
Y-225	73.7	Z-225	73.4	X-225A	68.6	X-90B	58.5
Y-180	71.9	Z-180	75.3	X-180A	70.8		
Y-135	72.3	Z-135	75.7	X-135A	69.1		
Y-90	71.8	Z-90	73.8	X-90A	68.5		
Y-45	70	Z-45	72.8	X-45A	69.3		

BELL 222

6-14-83

SITE 5H (HARD SITE)

HIGE		HOGE		FLT. IDLE		GND. IDLE	
Y-0	71.2	Z-0	79.9	X-0A	67.9	X-0B	63.4
Y-315	72.7	Z-315	81	X-315A	68.6	X-270B	65.2
Y-270	71.6	Z-270	80.4	X-270A	71.4	X-180B	60.1
Y-225	77.1	Z-225	82.7	X-225A	71.8	X-90B	61.9
Y-180	71.6	Z-180	81.3	X-180A	69.9		
Y-135	70.7	Z-135	78	X-135A	70.5		
Y-90	72.1	Z-90	79.4	X-90A	67.2		
Y-45	69.1	Z-45	76.5	X-45A	68.4		

APPENDIX F

Cockpit Instrument Photo Data

During each event of the June 1983 Helicopter Noise Measurement program cockpit photos were taken. The slides were projected onto a screen (considerably enlarged) making it possible to read the instruments with reasonable accuracy. The photos were supposed to be taken when the aircraft was directly over the centerline-center microphone site. Although this was not achieved in each case the cockpit photos reflect the helicopter "stabilized" configuration during the test event. One important caution is necessary in interpreting the photographic information; the snapshot freezes instrument readings at one moment of time whereas most readings are constantly changing by a small amount as the pilot "hunts" for the reference condition. Thus fluctuations above or below reference conditions are to be anticipated. The instrument readings are most useful in terms of verifying the region of operation for different parameters. The data acquisition is discussed in Section 5.3

Each table within this appendix provides the following inforamtion:

Event No.	This event number along with the test date provides a cross reference to other data.
Event Type	This specifies the event.
Time of Photo	The time of the range control synchronized clock consistent with acoustical and tracking time bases.
Heading	The compass magnetic heading which fluctuates around the target heading.
Altimeter	Specifies the barometric altimeter reading, one of the more stable indicators.
IAS	Indicated airspeed, a fairly stable indicator.
Rotor Speed	Main Rotor speed in RPM or percent, a very stable indicator.
Torque	The torque on the main rotor shaft, a fairly stable value.

TABLE F.1

COCKPIT PHOTO DATA

HELICOPTER BELL 212 TEST DATE 6-14-83

EVENT NO.	EVENT TYPE	TIME OF PHOTO	HEADING (DEGREES)	ALTIMETER (AGL) FT. (METERS)	IAS (KTS)	ROTOR SPEED (%)	TORQUE (%)
L1	APP ICAO	9:44:07	120	760	65	100	30
L2	APP ICAO	9:48	120	750	68	100	30
L3	APP ICAO	9:52	120	800	65	100	30
L4	APP ICAO	9:56	120	690	66	100	30
L5	APP ICAO	9:59	120	660	66	100	30
L6	APP ICAO	10:09	120	940	65	100	40
M7	APPROACH	10:17	120	620	44	100	40
M8	APPROACH	10:21	120	680	46	100	50
M9	APPROACH	10:25	120	690	45	100	40
N10	APPROACH	10:32	120	760	48	100	40
N11	APPROACH	10:36	120	780	48	100	34
N12	APPROACH	10:41	120	660	50	100	30
N13	APPROACH	10:44	120	750	56	100	30
O14	APPROACH	10:48	120	780	74	100	30
O15	APPROACH	10:52	120	760	75	100	30
O16	APPROACH	10:55	120	720	75	100	25
P17	APPROACH	10:59	120	820	85	100	25
P18	APPROACH	11:07	120	460	80	100	20
P19	APPROACH	11:11	120	750	84	100	35
K20	T/O ICAO	11:20	295	800	65	100	100
K21	T/O ICAO	11:24	300	760	65	100	98
K22	T/O ICAO	11:27	300	800	65	100	100
K23	T/O ICAO	11:30	300	760	70	100	99
K24	T/O ICAO	11:33	300	760	60	100	100
K25	T/O ICAO	11:36	295	820	64	100	100

TABLE F.1 (CONT)

COCKPIT PHOTO DATA

HELICOPTER BELL 222 (CONT) TEST DATE 6-14-83

EVENT NO.	EVENT TYPE	TIME OF PHOTO	HEADING (DEGREES)	ALTIMETER (AGL) FT. (METERS)	IAS (KTS)	ROTOR SPEED (%)	TORQUE (%)
T26	APPROACH	12:21	125	940	43	100	20
T27	APPROACH	12:24	125	960	47	100	20
T28	APPROACH	12:27	125	920	45	100	10
T29	APPROACH	12:32	120	900	45	100	25
U30	APPROACH	12:36	125	760	52	100	10
U31	APPROACH	12:39	120	820	53	100	20
U32	APPROACH	12:42	125	880	55	100	10
V33	APPROACH	12:48	120	840	65	100	0
V34	APPROACH	12:51	120	820	64	100	0
V35	APPROACH	12:54	125	850	62	100	10
W36	APPROACH	12:57	125	800	75	100	5
W37	APPROACH	13:00	125	760	72	100	0
W38	APPROACH	13:03	125	630	73	100	0
W39	APPROACH	13:06	125	820	74	100	10
W40	APPROACH	13:09	120	900	70	100	10

TABLE F.2

COCKPIT PHOTO DATA

HELICOPTER BELL 222 TEST DATE 6-15-83

EVENT NO.	EVENT TYPE	TIME OF PHOTO	HEADING (DEGREES)	ALTIMETER (AGL) FT. (METERS)	IAS (KTS)	ROTOR SPEED (%)	TORQUE (%)
A1	LFO 1000'.9Vne	13:00	120	1220	126	100	80
A2	LFO 1000'.9Vne	13:03	120	1320	127	100	85
A3	LFO 1000'.9Vne	13:06	125	1260	125	100	83
A4	LFO 1000'.9Vne	13:09	120	1320	125	100	90
A5	LFO 1000'.9Vne	13:12	120	1320	125	100	78
A6	LFO 1000'.9Vne	13:17	120	1240	128	100	80
B7	LFO 500' Vne	13:20	120	860	140	100	100
B8	LFO 500' Vne	13:24	120	780	146	100	100
B9	LFO 500' Vne	13:27	120	780	140	100	90
C10	LFO 500'.9Vne	13:31	120	790	127	100	75
C11	LFO 500'.9Vne	13:36	120	820	127	100	75
C12	LFO 500'.9Vne	13:44	120	780	127	100	70
C13	LFO 500'.9Vne	13:49	120	720	128	100	80
C14	LFO 500'.9Vne	13:53	120	800	127	100	80
C15	LFO 500'.9Vne	13:56	120	840	126	100	80
D16	LFO 500'.8Vne	14:00	120	800	114	100	60
D17	LFO 500'.8Vne	14:03	120	820	115	100	60
D18	LFO 500'.8Vne	14:07	120	820	115	100	60
E19	LFO 500'.7Vne	14:17	120	830	97	100	55
Q20	APPROACH	14:20	125	620	80	100	20
Q21	APPROACH	14:23	125	680	85	100	10
R22	APPROACH	14:27	125	740	65	100	10
S23	APPROACH	14:30	127	800	45	100	20

TABLE F.3

COCKPIT PHOTO DATA

HELICOPTER BELL 222 TEST DATE 6-16-83

EVENT NO.	EVENT TYPE	TIME OF PHOTO	HEADING (DEGREES)	ALTIMETER (AGL) FT. (METERS)	IAS (KTS)	ROTOR SPEED (%)	TORQUE (%)
Q24	APPROACH	10:46	120	600	64	100	30
Q25	APPROACH	10:50	120	500	70	100	25
Q26	APPROACH	10:53	120	520	72	100	10
Q27	APPROACH	10:56	120	680	60	100	10
Q28	APPROACH	10:59	120	780	58	[illegible]	10
Q29	APPROACH	11:02	120	560	80	100	10
Q30	APPROACH	11:05	130	380	48	100	25
Q31	APPROACH	11:08	125	620	45	100	10
Q32	APPROACH	11:12	125	390	45	100	35
Q33	APPROACH	11:14	125	790	68	100	5
Q34	APPROACH	11:17	125	720	60	100	5
Q35	APPROACH	11:20	120	680	70	100	5
Q36	APPROACH	11:22	130	660	65	100	0
Q37	APPROACH	11:27	130	800	55	100	15
Q38	APPROACH	11:30	125	700	70	100	0
Q39	APPROACH	11:3[illegible]	125	560	55	100	10
Q40	APPROACH	11:36	125	820	60	100	10
Q41	APPROACH	11:40	125	700	60	100	10
G42	LFO 700'Vne	12:06	120	960	140	100	90
G43	LFO 700'Vne	12:09	120	960	140	100	90
G44	LFO 700'Vne	12:12	120	980	140	100	90
H45	LFO 700'.9Vne	12:15	120	990	125	100	70
H46	LFO 700'.9Vne	12:17	120	1020	125	100	70
H47	LFO 700'.9Vne	12:20	120	1060	127	100	60
I48	LFO 700'.8Vne	12:23	120	1000	115	100	65
I49	LFO 700'.8Vne	12:25	125	1000	111	100	60

APPENDIX G

Photo-Altitude and Flight Path Trajectory Data

This appendix contains the results of the photo-altitude and flight path trajectory analysis.

The helicopter altitude over a given microphone was determined by a photographic technique which involves photographing an aircraft during a flyover event and proportionally scaling the resulting image with the known dimensions of the aircraft. The data acquisition is described in detail in Section 5.2. The detailed data reduction procedures is set out in Section 6.2.1; the analysis of these data is discussed in Section 8.2

Each table within this appendix provides the following information:

Event No.	the test run number
Est. Alt.	estimated altitude above microphone site
P-Alt.	altitude above photo site, determined by photographic technique
Est. CPA	estimated closest point of approach to microphone site
Est. ANG	Helicopter elevation with respect to the ground as viewed from a sideline site as the helicopter passes through a plane perpendicular to the flight track and coincident with the observer location.
ANG 5-1	flight path slope, expressed in degrees, between P-Alt site 5 and P-Alt site 1.
ANG 1-4	flight path slope, expressed in degrees, between P-Alt Site 1 and P-Alt Site 4.
ANG 5-4	flight path slope, expressed in degrees, between P-Alt Site 5 and P-Alt Site 4.
Reg C/D Angle	flight path slope, expressed in degress, of regression line through P-Alt data points.

HELICOPTER: BELL 222

TABLE G.1

TEST DATE: 6-15-83

OPERATION: 1000 FT FLYOVER(0.9*VNE)/TARGET IAS=123 KTS

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
EVENT NO	EST. ALT.	P-ALT.	EST. ALT.	P-ALT.	EST. ALT.	P-ALT.	EST. CPA	ELEV ANG	EST. CPA	ELEV ANG	ANG 5-1	ANG 1-4	ANG 5-4	C/D ANGLE
A1	901.1	942.6	1103.2	903	1264.3	1324.7	1207.9	66	1184.3	66.3	-4.50	40.60	21.22	18.8
A2	1015.2	1019	1042.4	1019.6	1064.1	1069.9	1152.7	64.7	1149.5	64.8	0.10	5.80	2.96	2.5
A3	969	966.7	965.5	972.5	962.8	959.8	1083.7	63	1084.1	63	0.70	-1.40	-0.40	-.2
A4	1043.2	1048.3	1017.4	1019.6	996.8	1002.1	1130.1	64.2	1133.1	64.2	-3.20	-1.90	-2.69	-2.3
A5	1039.4	1040.3	1002.9	1020.1	973.9	973.5	1117.1	63.9	1121.3	63.8	-2.30	-5.30	-3.88	-3.3
A6	917.4	908.6	901.3	929.6	888.5	876.8	1026.8	61.4	1028.7	61.3	2.40	-6.00	-1.85	-1.4

HELICOPTER: BELL 222

TABLE G.2

TEST DATE: 6-15-83

OPERATION: 500 FT FLYOVER(VNE)/TARGET IAS=137 KTS

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
EVENT NO	EST. ALT.	P-ALT.	EST. ALT.	P-ALT.	EST. ALT.	P-ALT.	EST. CPA	ELEV ANG	EST. CPA	ELEV ANG	ANG 5-1	ANG 1-4	ANG 5-4	C/D ANGLE
B7	460.2	457	454.4	464.8	449.8	445.5	669.8	42.7	670.3	42.7	0.90	-2.10	-0.67	-.4
B8	383.4	384.7	394	380.8	384.4	386	624.1	38	624	38	-0.40	0.60	0.08	0
B9	365.2	366	374.1	367.5	381.2	382.6	618.1	37.2	617.4	37.3	0.20	1.60	0.97	.8

HELICOPTER: BELL 222

TABLE G.3

TEST DATE: 6-15-83

OPERATION: 500 FT FLYOVER(0.9*VNE)/TARGET IAS=123 KTS

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
EVENT NO	EST. ALT.	P-ALT.	EST. ALT.	P-ALT.	EST. ALT.	P-ALT.	EST. CPA	ELEV ANG	EST. CPA	ELEV ANG	ANG 5-1	ANG 1-4	ANG 5-4	C/D ANGLE
C10	409.3	410.2	393.8	400.1	381.5	381.9	630.2	38.7	631.5	38.6	-1.10	-2.00	-1.65	-1.3
C11	452.5	444.9	451.5	469.1	450.7	441.1	667.7	42.5	667.8	42.5	2.80	-3.20	-0.22	0
C12	407.7	400	392.4	417.8	380.2	369.9	629.3	38.6	630.5	38.5	2.10	-5.50	-1.75	-1.3
C13	347.5	345.3	343.8	350.8	340.8	337.8	600.2	34.9	600.5	34.9	0.60	-1.40	-0.44	-.3
C14	386.3	382.8	382.8	392.6	380.1	375.5	623.4	37.9	623.7	37.9	1.10	-1.90	-0.43	-.2
C15	460	451.5	446.6	472.7	435.9	424.7	664.4	42.2	665.6	42.2	2.50	-5.50	-1.56	-1.1

HELICOPTER: BELL 222

TABLE G.4

TEST DATE: 6-15-83

OPERATION: 500 FT FLYOVER(0.8*VNE)/TARGET IAS=110 KTS

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
	EST.		EST.		EST.		EST.	ELEV	EST.	ELEV	ANG	ANG	ANG	C/D
EVENT NO	ALT.	P-ALT.	ALT.	P-ALT.	ALT.	P-ALT.	CPA	ANG	CPA	ANG	5-1	1-4	5-4	ANGLE
D16	430.4	418.9	421	451.8	413.5	398.7	647.5	40.6	648.3	40.5	3.80	-6.10	-1.18	-.8
D17	431.6	422.7	428.6	450.1	426.2	415	652.5	41.1	652.7	41	3.20	-4.00	-0.45	-.2
D18	424.4	412.1	430.8	455.1	435.9	420.8	654	41.2	653.4	41.2	5.00	-3.90	0.51	.6

HELICOPTER: BELL 222

TABLE G.5

TEST DATE: 6-15-83

OPERATION: 500 FT FLYOVER(0.7*VNE)/TARGET IAS=96 KTS

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
	EST.		EST.		EST.		EST.	ELEV	EST.	ELEV	ANG	ANG	ANG	C/D
EVENT NO	ALT.	P-ALT.	ALT.	P-ALT.	ALT.	P-ALT.	CPA	ANG	CPA	ANG	5-1	1-4	5-4	ANGLE
E19	330.1	471.3	305.2	0	285.3	461.4	579	31.8	580.7	31.7	-43.70	43.20	-0.58	-2.2

HELICOPTER: BELL 222

TABLE G.6

TEST DATE: 6-16-83

OPERATION: 700 FT FLYOVER(VNE)/TARGET IAS=137 KTS

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
	EST.		EST.		EST.		EST.	ELEV	EST.	ELEV	ANG	ANG	ANG	C/D
EVENT NO	ALT.	P-ALT.	ALT.	P-ALT.	ALT.	P-ALT.	CPA	ANG	CPA	ANG	5-1	1-4	5-4	ANGLE
G42	671.2	666.4	659	676.3	649.2	642.7	822.4	53.3	823.7	53.2	1.20	-3.80	-1.38	-1
G43	653.5	647.6	652.6	661.9	651.8	646.9	817.3	53	817.4	53	1.40	-1.60	-0.16	0
G44	673.3	667.9	669.7	683.7	666.9	660	831	53.7	831.4	53.7	1.80	-2.70	-0.46	-.2

HELICOPTER: BELL 222

TABLE G.7

TEST DATE: 6-16-83

OPERATION: 700 FT FLYOVER(0.9*VNE)/TARGET IAS=123 KTS

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
	EST.		EST.		EST.		EST.	ELEV	EST.	ELEV	ANG	ANG	ANG	C/D
EVENT NO	ALT.	P-ALT.	ALT.	P-ALT.	ALT.	P-ALT.	CPA	ANG	CPA	ANG	5-1	1-4	5-4	ANGLE
H45	691.7	685.7	721.1	715.1	750.5	NA	872.9	55.7	875.2	NA	3.40	NA	NA	3.4
H46	784.9	778	778.8	797.6	773.9	765	921.2	57.7	921.8	57.7	2.30	-3.70	-0.76	-.5
H47	767.3	767.5	769.6	768	771.5	771.8	913.5	57.4	913.2	57.4	0.10	0.40	0.25	.2

HELICOPTER: BELL 222

TABLE G.8

TEST DATE: 6-16-83

OPERATION: 700 FT FLYOVER(0.8*VNE)/TARGET IAS=110 KTS

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
	EST.		EST.		EST.		EST.	ELEV	EST.	ELEV	ANG	ANG	ANG	C/D
EVENT NO	ALT.	P-ALT.	ALT.	P-ALT.	ALT.	P-ALT.	CPA	ANG	CPA	ANG	5-1	1-4	5-4	ANGLE
I48	756.5	752.6	762.2	768.1	766.6	761.9	907.2	57.2	906.6	57.2	1.80	-0.60	0.54	.5
I49	720.1	714.3	726.5	736.3	731.6	724.6	877.5	55.9	876.8	55.9	2.60	-1.30	0.60	.6

HELICOPTER: BELL 222

TABLE G.9

TEST DATE: 6-14-83

OPERATION: ICAO TAKEOFF

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
	EST.		EST.		EST.		EST.	ELEV	EST.	ELEV	ANG	ANG	ANG	C/D
EVENT NO	ALT.	P-ALT.	ALT.	P-ALT.	ALT.	P-ALT.	CPA	ANG	CPA	ANG	5-1	1-4	5-4	ANGLE
K20	689.1	NA	737.3	729.9	776.6	768.7	886.8	56.3	889.8	NA	NA	4.50	NA	4.5
K21	472.6	438.1	618.5	619.3	734.9	697.7	790.4	51.5	775.8	52	20.20	9.10	14.78	13.6
K22	563.4	529.8	723.4	717.1	859.9	824.6	879	56	861.6	56.4	20.80	12.30	16.68	15.3
K23	523.2	481.3	760.6	729.9	949.8	907	905.8	57.1	880.5	57.7	26.80	19.80	23.39	22
K24	552.4	513.9	735	725.6	880.6	839.8	884.5	56.2	865.2	56.7	23.30	13.10	18.32	17
K25	576.6	546.8	808.1	753.2	992.7	964.9	946.1	58.7	920.9	59.2	22.80	23.30	23.02	21.5

HELICOPTER: BELL 222

TABLE G.10

TEST DATE: 6-14-83

OPERATION: 6 DEGREE ICAO APPROACH/TARGET IAS=65 [illegible]

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
	EST.		EST.		EST.		EST.	ELEV	EST.	ELEV	ANG	ANG	ANG	C/D
EVENT NO	ALT.	P-ALT.	ALT.	P-ALT.	ALT.	P-ALT.	CPA	ANG	CPA	ANG	5-1	1-4	5-4	ANGLE
L1	307.1	295.9	380.4	367	438.8	427.8	621.9	37.7	616.2	38.1	8.20	7.00	7.63	6.8
L2	313.1	303.8	392.8	371.7	456.3	447.9	629.5	38.6	623.2	39	7.90	8.80	8.33	7.4
L3	293.8	287.2	352.9	336.7	400	394.1	605.5	35.7	601.1	36	5.70	6.70	6.20	5.5
L4	290.2	282.4	364	342.8	422.9	416.1	612	36.5	606.5	36.9	7.00	8.50	7.74	6.9
L5	286.1	279	359	336.7	417.2	411.2	609.1	36.1	603.6	36.5	6.70	8.60	7.65	6.8
L6	283.1	280.1	374.1	332.8	446.8	446.8	618.1	37.3	611.1	37.7	6.10	13.00	9.62	8.5

HELICOPTER: BELL 222

TABLE G.11

TEST DATE: 6-14-83

OPERATION: 6 DEGREE APPROACH/TARGET IAS=45 KTS

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
	EST.		EST.		EST.		EST.	ELEV	EST.	ELEV	ANG	ANG	ANG	C/D
EVENT NO	ALT.	P-ALT.	ALT.	P-ALT.	ALT.	P-ALT.	CPA	ANG	CPA	ANG	5-1	1-4	5-4	ANGLE
M7	285.4	275.6	355.4	340.7	411.3	401.8	607	35.8	601.8	36.2	7.50	7.10	7.31	6.5
M8	303.1	298.5	352.2	336.7	391.4	387.6	605.1	35.6	601.4	35.9	4.40	5.90	5.17	4.6
M9	292.1	284.8	360.4	340.7	414.9	408.6	609.9	36.2	604.7	36.6	6.50	7.90	7.17	6.3

HELICOPTER: BELL 222

TABLE G.12

TEST DATE: 6-14-83

OPERATION: 6 DEGREE APPROACH/TARGET IAS=55 KTS

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
	EST.		EST.		EST.		EST.	ELEV	EST.	ELEV	ANG	ANG	ANG	C/D
EVENT NO	ALT.	P-ALT.	ALT.	P-ALT.	ALT.	P-ALT.	CPA	ANG	CPA	ANG	5-1	1-4	5-4	ANGLE
N10	289.8	285.4	372.3	338.7	438.1	436	617	37.1	610.7	37.6	6.20	11.20	8.70	7.7
N11	293.3	288.4	353.5	332.8	401.5	397.8	605.8	35.7	601.4	36	5.20	7.50	6.34	5.6
N12	281.8	276.7	391.1	344.9	478.4	476.5	628.5	38.5	619.9	39.1	7.90	15.00	11.48	10.2
N13	286.3	280.1	355.5	332.9	410.7	405.8	607	35.9	601.8	36.2	6.10	8.40	7.28	6.4

TABLE G.13

HELICOPTER: BELL 222

TEST DATE: 6-14-83

OPERATION: 6 DEGREE APPROACH/TARGET IAS=75 KTS

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
	EST.		EST.		EST.		EST.	ELEV	EST.	ELEV	ANG	ANG	ANG	C/D
EVENT NO	ALT.	P-ALT.	ALT.	P-ALT.	ALT.	P-ALT.	CPA	ANG	CPA	ANG	5-1	1-4	5-4	ANGLE
014	296.9	289.6	354.9	340.7	401.1	394.4	606.6	35.8	602.3	36.1	5.90	6.20	6.08	5.4
015	306.1	298.5	370	353.4	420.9	414	615.6	36.9	610.7	37.3	6.40	7.00	6.69	5.9
016	284.8	273.4	348.5	340.7	399.3	387.6	602.9	35.3	598.3	35.7	7.80	5.40	6.62	5.9

TABLE G.14

HELICOPTER: BELL 222

TEST DATE: 6-14-83

OPERATION: 6 DEGREE APPROACH/TARGET IAS=85 KTS

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
	EST.		EST.		EST.		EST.	ELEV	EST.	ELEV	ANG	ANG	ANG	C/D
EVENT NO	ALT.	P-ALT.	ALT.	P-ALT.	ALT.	P-ALT.	CPA	ANG	CPA	ANG	5-1	1-4	5-4	ANGLE
P17	287.1	277	352.3	340.7	404.4	394.4	605.2	35.6	600.3	36	7.40	6.20	6.80	6.1
P18	306.1	295.9	376.4	362.3	432.4	422.5	619.4	37.4	614	37.8	7.70	7.00	7.33	6.5
P19	310.5	298.9	374.7	367	425.9	414	618.4	37.3	613.5	37.6	7.90	5.50	6.67	6

TABLE G.15

HELICOPTER: BELL 222

TEST DATE: 6-15-83

OPERATION: EXPIMENTAL MULTI SEGMENT APPROACH

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
	EST.		EST.		EST.		EST.	ELEV	EST.	ELEV	ANG	ANG	ANG	C/D
EVENT NO	ALT.	P-ALT.	ALT.	P-ALT.	ALT.	P-ALT.	CPA	ANG	CPA	ANG	5-1	1-4	5-4	ANGLE
020	106.4	98.8	171.5	154.4	223.3	216.4	521	19.2	518.3	19.7	6.40	7.20	6.82	6
021	172.7	160.7	239.9	231.4	293.5	281.3	547.4	26	543.7	26.5	8.20	5.80	6.99	6.2

HELICOPTER: BELL 222

TABLE G.16

TEST DATE: 6-16-93

OPERATION: EXPERIMENTAL MULTI SEGMENT APPROACH

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
EVENT NO	EST. ALT.	P-ALT.	EST. ALT.	P-ALT.	EST. ALT.	P-ALT.	EST. CPA	ELEV ANG	EST. CPA	ELEV ANG	ANG 5-1	ANG 1-4	ANG 5-4	C/D ANGLE
024	140.8	132	192.4	184.9	233.6	224.7	528.3	21.4	525.9	21.7	6.10	4.60	5.38	4.8
025	107.[illegible]	95.2	180.1	170.8	237.7	224.7	523.9	20.1	520.8	20.7	8.70	6.30	7.50	6.7
026	114.5	97.5	203.1	194.8	273.8	256.1	532.3	22.4	528.1	23.1	11.20	7.10	9.16	8.2
027	136.2	118.8	247.1	227.8	335.6	318.4	550.6	26.7	544.4	27.4	12.50	10.40	11.47	10.3
028	207.1	180.1	346	333.7	456.7	426.5	601.5	35.1	591.4	35.9	17.30	10.90	14.17	12.9
029	108.2	95.6	171.3	166.4	[illegible]21.6	208.4	521	19.2	518.4	19.7	8.20	4.90	6.54	5.9
030	75.9	64.9	202.9	160.6	304.3	295.8	532.2	22.4	526.2	23.4	11.00	15.40	13.21	11.8
031	196.8	160.3	329.6	341.7	435.5	395.2	592.2	33.8	582.9	34.6	20.20	6.20	13.43	12.3
032	117.6	87	275.6	261.2	401.6	369.7	563.9	29.3	554.3	30.3	19.50	12.40	16.03	14.7
033	228.3	199.1	337.1	345.4	423.9	391.8	596.4	34.4	588.6	35.1	16.60	5.40	11.08	10.1
034	194.3	162.9	312.8	321.2	407.3	372.7	583	32.4	575	33.2	17.80	6.00	12.04	11
035	189.4	169.2	283.5	279.3	358.5	337.1	567.6	29.9	561.9	30.6	12.60	6.70	9.68	8.7
036	230.9	211.5	322.9	318.1	396.3	375.8	588.5	33.3	582.1	33.8	12.20	6.70	9.48	8.5
037	279.4	251.8	395.7	396.6	488.3	458.5	631.4	38.8	622.1	39.4	16.40	7.20	11.86	10.8
038	150.6	131.3	255	243.4	338.3	318.4	554.2	27.4	548.1	78.1	12.60	8.70	10.77	9.7
039	162	137.2	262.8	265.5	343.1	316.2	557.8	28.1	551.8	28.8	14.60	5.90	10.31	9.4
040	141.8	111.1	296.9	284.3	420.6	388.5	574.7	31.1	564.6	32.1	19.40	12.00	15.74	14.4
041	165	130.7	303.3	307.6	413.6	376.3	578	31.7	568.9	32.5	19.80	7.90	14.01	12.8

HELICOPTER: BELL 222

TABLE G.17

TEST DATE: 6-15-83

OPERATION: EXPERIMENTAL MULTI SEGMENT APPROACH

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					
EVENT NO	EST. ALT.	P-ALT.	EST. ALT.	P-ALT.	EST. ALT.	P-ALT.	EST. CPA	ELEV ANG	EST. CPA	ELEV ANG	ANG 5-1	ANG 1-4	ANG 5-4	REG. C/D ANGLE
R22	108.6	88.4	238.6	215.6	342.3	322.3	546.8	25.9	537.8	26.8	14.50	12.20	13.37	12.1

HELICOPTER: BELL 222

TABLE G.18

TEST DATE: 6-15-83

OPERATION: EXPERIMENTAL MULTI SEGMENT APPROACH

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					
EVENT NO	EST. ALT.	P-ALT.	EST. ALT.	P-ALT.	EST. ALT.	P-ALT.	EST. CPA	ELEV ANG	EST. CPA	ELEV ANG	ANG 5-1	ANG 1-4	ANG 5-4	REG. C/D ANGLE
S23	116.7	92.1	280.4	249.4	411	386.9	566.3	29.7	556.2	30.7	17.70	15.60	16.68	15.2

HELICOPTER: BELL 222

TABLE G.19

TEST DATE: 6-14-83

OPERATION: 12 DEGREE APPROACH/TARGET IAS=45 KTS

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					
EVENT NO	EST. ALT.	P-ALT.	EST. ALT.	P-ALT.	EST. ALT.	P-ALT.	EST. CPA	ELEV ANG	EST. CPA	ELEV ANG	ANG 5-1	ANG 1-4	ANG 5-4	REG. C/D ANGLE
T26	NA	159.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T27	270.3	251.3	413.6	380.8	527.9	510	642.8	40.1	631.1	40.8	14.70	14.70	14.73	13.3
T28	248.7	229.9	389.9	357.8	502.5	484.7	627.8	38.4	616.7	39.1	14.60	14.50	14.52	13.1
T29	250.7	228.6	391.2	367	503.3	481.3	628.6	38.5	617.6	39.2	15.70	13.10	14.40	13

TABLE G.20

HELICOPTER: BELL 222

TEST DATE: 6-14-83

OPERATION: 12 DEGREE APPROACH/TARGET IAS=55 KTS

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
	EST.		EST.		EST.		EST.	ELEV	EST.	ELEV	ANG	ANG	ANG	C/D
EVENT NO	ALT.	P-ALT.	ALT.	P-ALT.	ALT.	P-ALT.	CPA	ANG	CPA	ANG	5-1	1-4	5-4	ANGLE
U30	254.7	239	388.7	353.4	495.5	481.3	627	38.3	616.5	39	13.10	14.60	13.83	12.4
U31	267.9	248.5	395.3	371.7	496.9	477.9	631.1	38.8	621	39.4	14.10	12.20	13.12	11.8
U32	264.5	248.5	385.5	357.8	482	466.9	625	38.1	615.6	38.7	12.50	12.50	12.51	11.2

TABLE G.21

HELICOPTER: BELL 222

TEST DATE: 6-14-83

OPERATION: 12 DEGREE APPROACH/TARGET IAS=65 KTS

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
	EST.		EST.		EST.		EST.	ELEV	EST.	ELEV	ANG	ANG	ANG	C/D
EVENT NO	ALT.	P-ALT.	ALT.	P-ALT.	ALT.	P-ALT.	CPA	ANG	CPA	ANG	5-1	1-4	5-4	ANGLE
V33	252	232.5	392.4	362.3	504.4	485.7	629.3	38.6	618.3	39.3	14.80	14.10	14.43	13
V34	258.5	233.3	388.4	376.6	491.9	465.7	626.8	38.3	616.6	39	16.20	10.30	13.29	12.1
V35	258.7	237.8	388.4	367	491.9	471.1	626.9	38.3	616.7	39	14.70	11.90	13.34	12.1

TABLE G.22

HELICOPTER: BELL 222

TEST DATE: 6-14-83

OPERATION: 12 DEGREE APPROACH/TARGET IAS=70 KTS

	CENTERLINE						SIDELINE							
	MIC #5		MIC #1		MIC #4		MIC #2		MIC #3					REG.
	EST.		EST.		EST.		EST.	ELEV	EST.	ELEV	ANG	ANG	ANG	C/D
EVENT NO	ALT.	P-ALT.	ALT.	P-ALT.	ALT.	P-ALT.	CPA	ANG	CPA	ANG	5-1	1-4	5-4	ANGLE
W36	277.5	243.2	418.5	421.4	531	493.8	645.9	40.4	634.4	41.1	19.90	8.40	14.29	13.1
W37	264.2	236.3	395.8	389.3	500.7	471.1	631.4	38.8	621	39.5	17.30	9.40	13.42	12.2
W38	254.2	227.1	401.7	384.9	519.3	491.4	635.1	39.2	623.4	40	17.80	12.20	15.03	13.7
W39	254.3	227.1	393.7	381.6	504.9	476.5	630.2	38.7	619.2	39.4	17.40	10.90	14.22	12.9
W40	271.8	234.2	402.9	418.5	507.4	465.7	635.9	39.3	625.4	40	20.50	5.50	13.24	12.2

APPENDIX H

NWS Upper Air Meteorological Data

This appendix presents a summary of meteorological data gleaned from National Weather Service radiosonde (rawinsonde) weather balloon ascensions conducted at Sterling, VA. The data collection is further described in Section 5.4. Tables are identified by launch date and launch time. Within each table the following data are provided:

Time	expressed first in eastern standard, then in eastern daylight time
Surface Height	height of launch point with respect to sea level
Height	height above ground level, expressed in feet
Pressure	expressed in millibars
Temperature	expressed in degrees centigrade
Relative Humidity	expressed as a percent
Wind Direction	measured in the direction from which the wind is blowing
Wind Speed	expressed in knots

TABLE H.1.1

DATE: 6 / 14 / 83

TIME: 508 EST FLIGHT # 1 608 EDT

SURFACE HEIGHT= 279 FT MSL -999= MISSING DATA

HEIGHT FEET	PRESSURE MB	TEMPERATURE DEG C	RELATIVE HUMIDITY	WIND DIRECTION	WIND SPEED KTS
0	1007.9	17.2	95	0	0
100	1004.4	18.4	99	-999	-999
200	1000.8	19.5	99	-999	-999
300	997.3	21.2	84	334	12
400	993.8	23.1	66	349	9
500	990.3	24.8	60	351	7
600	986.9	25.3	54	360	6
700	983.5	25.6	50	353	7
800	980.1	25.5	49	351	7
900	976.7	25.4	49	351	7
1000	973.4	25.2	49	2	7
1100	970.0	25.1	48	8	7
1200	966.6	24.9	48	26	6
1300	963.3	24.6	49	31	6
1400	959.9	24.4	49	29	6
1500	956.6	24.1	49	39	7
1600	953.2	23.8	50	35	7
1700	949.9	23.6	50	31	7
1800	946.7	23.3	50	35	8
1900	943.4	23.1	51	39	7
2000	940.1	22.9	51	43	6
2100	936.9	22.7	51	39	6
2200	933.6	22.4	52	35	7
2300	930.3	22.2	52	34	7
2400	927.0	22.0	52	38	6
2500	923.8	21.8	53	38	6
2600	920.5	21.5	53	39	6
2700	917.3	21.2	54	40	5
2800	914.1	20.9	54	35	5
2900	910.9	20.6	55	37	6
3000	907.7	20.3	56	37	6

TABLE H.1.2

DATE: 6 / 14 / 83

TIME: 533 EST FLIGHT # 2 633 EDT

SURFACE HEIGHT= 279 FT MSL -999= MISSING DATA

HEIGHT FEET	PRESSURE MB	TEMPERATURE DEG C	RELATIVE HUMIDITY	WIND DIRECTION	WIND SPEED KTS
0	1008.5	16.8	95	0	0
100	1004.9	19.2	97	-999	-999
200	1001.4	19.6	91	-999	-999
300	997.9	20.4	80	358	9
400	994.4	21.4	69	339	10
500	990.9	22.3	63	335	10
600	987.4	23.2	58	335	9
700	984.0	24.0	56	344	7
800	980.6	24.2	55	352	7
900	977.2	24.4	54	357	6
1000	973.8	24.6	54	359	8
1100	970.4	24.6	54	2	8
1200	967.1	24.6	54	15	8
1300	963.7	24.6	53	17	8
1400	960.3	24.6	53	26	8
1500	957.0	24.5	53	31	7
1600	953.7	24.3	53	34	8
1700	950.5	24.1	54	32	8
1800	947.2	23.9	54	27	9
1900	943.9	23.7	55	45	8
2000	940.7	23.5	55	37	8
2100	937.4	23.2	55	38	8
2200	934.1	23.0	56	35	8
2300	930.8	22.8	56	31	7
2400	927.6	22.6	56	34	6
2500	924.3	22.4	57	38	6
2600	921.1	22.1	57	32	5
2700	917.9	21.8	58	29	5
2800	914.7	21.6	58	30	5
2900	911.6	21.3	59	31	5
3000	908.4	21.0	60	29	5

NOTE: Temperatures above surface are about 0.8°C higher than they should be.

TABLE H.1.3

DATE: 6 / 14 / 83

TIME: 556 EST FLIGHT # 3 656 EDT

SURFACE HEIGHT= 279 FT MSL -999= MISSING DATA

HEIGHT FEET	PRESSURE MB	TEMPERATURE DEG C	RELATIVE HUMIDITY	WIND DIRECTION	WIND SPEED KTS
0	1008.8	17.7	95	340	2
100	1005.2	18.5	90	-999	-999
200	1001.7	20.7	83	-999	-999
300	998.2	22.4	74	-999	-999
400	994.7	23.1	65	351	13
500	991.3	23.6	61	321	18
600	987.8	24.1	59	315	15
700	984.4	24.6	56	327	9
800	981.0	24.8	55	6	7
900	977.6	24.7	54	15	10
1000	974.2	24.7	54	24	8
1100	970.9	24.7	53	14	6
1200	967.5	24.7	53	349	7
1300	964.1	24.6	52	345	11
1400	960.7	24.5	52	351	11
1500	957.4	24.2	52	356	11
1600	954.1	23.9	52	12	8
1700	950.8	23.7	52	36	6
1800	947.5	23.4	53	17	8
1900	944.2	23.1	53	15	9
2000	940.8	22.8	53	16	10
2100	937.5	22.5	53	11	11
2200	934.3	22.3	53	18	11
2300	931.1	22.1	54	36	9
2400	927.8	21.8	54	48	8
2500	924.6	21.6	55	38	9
2600	921.4	21.3	55	52	9
2700	918.1	21.1	55	80	6
2800	914.9	20.8	56	47	3
2900	911.7	20.6	56	357	3
3000	908.5	20.4	57	339	5

TABLE H.1.4

DATE: 6 / 14 / 83

TIME: 835 EST FLIGHT # 4 935 EDT

SURFACE HEIGHT= 279 FT MSL -999= MISSING DATA

HEIGHT FEET	PRESSURE MB	TEMPERATURE DEG C	RELATIVE HUMIDITY	WIND DIRECTION	WIND SPEED KTS
0	1009.4	25.6	70	340	5
100	1005.9	24.8	68	-999	-999
200	1002.4	24.4	66	-999	-999
300	998.9	24.3	64	356	7
400	995.5	24.1	62	352	8
500	992.0	23.9	61	350	10
600	988.6	23.7	59	356	11
700	985.2	24.2	56	360	11
800	981.8	24.4	55	2	12
900	978.3	24.5	54	9	12
1000	974.9	24.6	53	17	11
1100	971.5	24.6	53	31	9
1200	968.2	24.5	53	28	9
1300	964.8	24.4	53	30	8
1400	961.5	24.4	53	27	9
1500	958.2	24.1	53	17	9
1600	954.9	23.9	53	20	8
1700	951.6	23.6	53	18	8
1800	948.3	23.4	53	17	8
1900	944.9	23.1	54	16	8
2000	941.6	22.9	54	16	8
2100	938.3	22.6	54	21	9
2200	935.0	22.4	54	23	9
2300	931.8	22.1	54	21	9
2400	928.5	21.8	55	16	9
2500	925.3	21.6	55	21	9
2600	922.1	21.3	55	20	10
2700	918.8	21.0	56	22	9
2800	915.6	20.7	56	20	9
2900	912.4	20.5	56	17	9
3000	909.1	20.2	57	16	9

TABLE H.1.5

DATE: 6 / 14 / 83

TIME: 858 EST FLIGHT # 5 958 EDT

SURFACE HEIGHT= 279 FT MSL -999- MISSING DATA

HEIGHT FEET	PRESSURE MB	TEMPERATURE DEG C	RELATIVE HUMIDITY	WIND DIRECTION	WIND SPEED KTS
0	1009.3	26.1	62	340	4
100	1005.8	26.0	61	-999	-999
200	1002.4	25.8	60	-999	-999
300	998.9	25.4	60	10	6
400	995.4	25.1	61	333	8
500	992.0	24.9	60	337	7
600	988.6	24.8	59	354	7
700	985.2	24.6	60	10	6
800	981.7	24.3	61	26	5
900	978.3	24.4	58	31	7
1000	974.9	24.5	54	33	9
1100	971.6	24.5	53	39	9
1200	968.2	24.5	52	38	8
1300	964.9	24.5	51	40	8
1400	961.5	24.2	51	36	8
1500	958.2	23.8	51	29	9
1600	954.8	23.5	51	34	8
1700	951.5	23.5	50	25	7
1800	948.2	23.4	50	10	7
1900	944.9	23.2	51	10	7
2000	941.6	23.0	51	13	8
2100	938.3	22.8	52	17	9
2200	935.0	22.6	52	16	8
2300	931.8	22.4	52	17	8
2400	928.6	22.2	52	15	8
2500	925.4	21.9	52	14	8
2600	922.1	21.7	52	17	8
2700	918.9	21.5	52	18	8
2800	915.7	21.3	51	18	9
2900	912.5	21.1	51	18	8
3000	909.2	20.8	51	20	8

TABLE H.1.6

DATE: 6 / 14 / 83

TIME: 1000 EST FLIGHT # 6 1100 EDT

SURFACE HEIGHT= 279 FT MSL -999= MISSING DATA

HEIGHT FEET	PRESSURE MB	TEMPERATURE DEG C	RELATIVE HUMIDITY	WIND DIRECTION	WIND SPEED KTS
0	1009.1	27.9	59	330	4
100	1005.6	27.3	54	-999	-999
200	1002.1	27.1	54	-999	-999
300	998.7	26.8	54	350	6
400	995.3	26.5	55	354	3
500	991.9	26.1	55	314	6
600	988.5	25.8	56	342	6
700	985.1	25.5	57	339	5
800	981.7	25.2	57	353	5
900	978.3	24.9	58	24	4
1000	974.9	24.6	58	44	4
1100	971.5	24.2	59	27	5
1200	968.2	24.1	58	31	5
1300	964.8	24.0	56	21	4
1400	961.4	23.8	54	2	4
1500	958.1	23.7	53	352	6
1600	954.7	23.[illegible]	51	352	6
1700	951.4	23.5	50	358	6
1800	948.1	23.5	49	8	6
1900	944.8	23.5	48	12	7
2000	941.5	23.4	47	15	7
2100	938.3	23.1	47	14	7
2200	935.0	22.8	47	10	8
2300	931.8	22.5	47	12	8
2400	928.5	22.3	47	14	8
2500	925.2	22.0	47	12	8
2600	922.0	21.7	47	11	8
2700	918.7	21.4	47	13	8
2800	915.5	21.2	47	16	8
2900	912.3	21.0	48	16	8
3000	909.1	20.8	49	22	8

TABLE H.2.1

DATE: 6 / 15 / 83

TIME: 1156 EST FLIGHT # 1 1256 EDT

SURFACE HEIGHT= 279 FT MSL -999= MISSING DATA

HEIGHT FEET	PRESSURE MB	TEMPERATURE DEG C	RELATIVE HUMIDITY	WIND DIRECTION	WIND SPEED KTS
0	1005.1	29.2	54	0	0
100	1001.6	28.8	59	-999	-999
200	998.2	28.5	61	-999	-999
300	994.8	28.3	62	112	2
400	991.5	28.0	62	249	3
500	988.1	27.8	63	240	1
600	984.7	27.6	63	254	1
700	981.3	27.4	63	12	1
800	977.9	27.2	64	280	1
900	974.6	26.9	64	283	2
1000	971.3	26.6	65	311	1
1100	967.9	26.4	66	260	1
1200	964.6	26.1	66	273	1
1300	961.3	25.8	67	257	1
1400	958.0	25.6	68	218	2
1500	954.7	25.3	69	190	1
1600	951.4	24.9	70	207	2
1700	948.1	24.6	71	154	4
1800	944.8	24.3	73	135	4
1900	941.5	23.9	74	126	6
2000	938.2	23.5	74	122	6
2100	934.9	23.1	75	120	6
2200	931.7	22.7	75	117	7
2300	928.5	22.5	75	114	6
2400	925.3	22.4	76	116	6
2500	922.1	22.3	75	128	6
2600	918.8	22.1	75	132	6
2700	915.6	21.9	76	128	6
2800	912.4	21.7	76	128	6
2900	909.2	21.5	76	135	6
3000	906.0	21.4	77	142	6

TABLE H.2.2

DATE: 6 / 15 / 83

TIME: 758 EST FLIGHT # 2 858 EDT

SURFACE HEIGHT= 279 FT MSL -999= MISSING DATA

HEIGHT FEET	PRESSURE MB	TEMPERATURE DEG C	RELATIVE HUMIDITY	WIND DIRECTION	WIND SPEED KTS
0	1004.7	30.6	53	0	0
100	1001.3	29.9	54	-999	-999
200	997.9	29.3	55	-999	-999
300	994.5	28.9	56	-999	-999
400	991.1	28.4	57	232	3
500	987.7	28.0	57	159	3
600	984.3	27.5	58	98	4
700	981.0	27.1	59	114	2
800	977.6	26.7	59	210	3
900	974.3	26.4	60	236	3
1000	970.9	26.2	60	213	2
1100	967.6	25.9	60	158	1
1200	964.3	25.7	61	137	2
1300	960.9	25.4	61	136	2
1400	957.6	25.1	61	149	2
1500	954.3	24.9	62	174	1
1600	951.0	24.6	62	194	2
1700	947.7	24.2	63	211	2
1800	944.4	23.7	64	224	3
1900	941.1	23.3	65	225	4
2000	937.8	22.9	66	213	4
2100	934.5	22.7	68	198	4
2200	931.3	22.6	70	169	4
2300	928.0	22.2	66	148	4
2400	924.8	22.0	67	153	4
2500	921.6	21.8	67	150	3
2600	918.4	21.5	68	142	3
2700	915.2	21.3	68	141	3
2800	912.0	21.1	69	141	3
2900	908.8	20.9	69	140	3
3000	905.5	20.6	70	145	4

TABLE H.3.1

DATE: 6 / 16 / 83

TIME: 951 EST FLIGHT # 1 1051 EDT

SURFACE HEIGHT= 279 FT MSL -999= MISSING DATA

HEIGHT FEET	PRESSURE MB	TEMPERATURE DEG C	RELATIVE HUMIDITY	WIND DIRECTION	WIND SPEED KTS
0	1007.3	27.8	65	210	2
100	1004.0	27.0	60	-999	-999
200	1000.6	26.5	63	257	2
300	997.1	25.9	65	281	2
400	993.7	25.4	66	281	3
500	990.3	25.4	69	273	4
600	986.9	25.3	72	254	2
700	983.5	25.1	73	208	2
800	980.1	24.7	72	218	2
900	976.6	24.3	73	226	2
1000	973.3	24.0	73	223	3
1100	969.9	23.8	71	229	4
1200	966.6	23.7	69	242	4
1300	963.2	23.5	68	231	4
1400	959.9	23.4	66	218	4
1500	956.5	23.2	65	221	4
1600	953.2	23.0	65	225	5
1700	949.9	22.7	64	224	4
1800	946.5	22.3	65	222	4
1900	943.2	21.9	66	222	4
2000	940.0	21.7	66	214	4
2100	936.7	21.5	65	221	4
2200	933.4	21.2	65	215	3
2300	930.1	21.0	66	217	3
2400	926.8	20.7	66	203	3
2500	923.6	20.4	67	214	4
2600	920.3	20.3	67	215	5
2700	917.1	20.2	68	214	5
2800	913.9	20.1	68	214	5
2900	910.7	20.1	69	211	5
3000	907.4	19.9	69	203	4

TABLE H.3.2

DATE: 6 / 16 / 83

TIME: 1047 EST FLIGHT # 2 1147 EDT

SURFACE HEIGHT= 279 FT MSL -999- MISSING DATA

HEIGHT FEET	PRESSURE MB	TEMPERATURE DEG C	RELATIVE HUMIDITY	WIND DIRECTION	WIND SPEED KTS
0	1007.5	28.9	53	0	0
100	1004.0	28.2	56	-999	-999
200	1000.6	27.5	59	-999	-999
300	997.2	27.1	61	-999	-999
400	993.7	26.7	62	287	3
500	990.3	26.4	63	22	1
600	986.9	26.0	64	63	3
700	983.5	25.7	65	63	3
800	980.1	25.5	66	95	2
900	976.7	25.3	67	102	3
1000	973.4	24.9	68	131	2
1100	970.0	24.6	69	192	3
1200	966.6	24.2	70	234	2
1300	963.3	23.8	71	240	2
1400	959.9	23.5	72	214	2
1500	956.6	23.3	73	208	2
1600	953.3	23.1	73	205	3
1700	950.0	22.9	74	207	4
1800	946.7	22.6	75	221	4
1900	943.4	22.2	77	212	5
2000	940.0	21.9	78	214	5
2100	936.8	21.4	77	222	6
2200	933.6	21.1	79	211	5
2300	930.2	20.7	81	198	4
2400	926.9	20.4	83	208	4
2500	923.7	20.3	80	223	4
2600	920.5	20.2	78	215	5
2700	917.3	20.2	75	207	6
2800	914.1	20.1	72	213	5
2900	910.9	20.0	70	214	6
3000	907.6	19.5	71	216	6

APPENDIX I

NWS - IAD Surface Meteorological Data

This appendix presents a summary of meteorological data gleaned from measurements conducted by the National Weather Service Station at Dulles. Readings were noted evey 15 minutes during the test. The data acquisition is described in Section 5.5.

Within each table the following data are provided:

Time(EDT)	time the measurement was taken, expressed in eastern daylight time
Barometric pressure	expressed in inches of mercury
Temperature	expressed in degrees fahrenheit and centigrade
Humidity	relative, expressed as a percent
Wind Speed	expressed in knots
Wind Direction	direction from which the wind is moving

TABLE I.1

SURFACE METEOROLOGICAL DATA (NWS)

TEST DATE: 6-14-83 HELICOPTER: BELL 222 LOCATION: DULLES AIRPORT*

TIME (EDT)	BAROMETRIC PRESSURE (INCHES)	TEMPERATURE °F(°C)	HUMIDITY (%)	WIND SPEED (MPH)	WIND DIRECTION (DEGREES)
05:30	30.06	61 (16)	100	00	00
05:45	30.07	61 (16)	100	00	00
06:00	30.07	62 (17)	100	00	00
06:15	30.08	62 (17)	97	03	350
06:30	30.08	63 (17)	97	03	350
06:45	30.08	64 (18)	97	03	350
07:00	30.09	65 (18)	93	03	360
07:15	30.09	66 (19)	93	04	010
07:30	30.09	67 (19)	93	04	350
07:45	30.09	68 (20)	93	05	350
08:00	30.09	69 (21)	93	05	350
08:15	30.10	70 (21)	93	05	340
08:31	30.10	72 (22)	90	05	350
08:45	30.11	73 (23)	85	05	340
09:00	30.11	75 (24)	82	04	350
09:15	30.11	76 (24)	82	05	340
09:30	30.11	77 (25)	79	06	340
09:45	30.11	78 (26)	77	05	340
10:00	30.10	79 (26)	74	05	350
10:15	30.10	80 (27)	72	03	360
10:30	30.10	81 (27)	70	06	340

*NOTE: SENSORES LOCATED APPROXIMATELY 2 MILES EAST OF MEASUREMENT ARRAY.

TABLE I.1 (continued)

SURFACE METEOROLOGICAL DATA (NWS)

TEST DATE: 6-14-83 HELICOPTER: BELL 222 (CONT) LOCATION: DULLES AIRPORT*

TIME (EDT)	BAROMETRIC PRESSURE (INCHES)	TEMPERATURE °F(°C)	HUMIDITY (%)	WIND SPEED (MPH)	WIND DIRECTION (DEGREES)
10:44	30.10	81 (27)	69	06	340
10:59	30.10	82 (28)	66	03	310
11:16	30.10	83 (28)	63	05	020
11:30	30.09	84 (29)	61	07	320
11:45	30.09	84 (29)	61	07	290
12:00	30.09	84 (29)	60	04	350
1:00	30.09	85 (29)	57	05	080
2:00	30.09	37 (30)	52	04	340
3:00	30.09	87 (30)	48	06	290
4:00	30.09	89 (31)	45	06	050

*NOTE: SENSORS LOCATED APPROXIMATELY 2 MILES EAST OF MEASUREMENT ARRAY.

TABLE I.2

SURFACE METEOROLOGICAL DATA (NWS)

TEST DATE: 6-16-83 HELICOPTER: BELL 222 LOCATION: DULLES AIRPORT*

TIME (EDT)	BAROMETRIC PRESSURE (INCHES)	TEMPERATURE °F(°C)	HUMIDITY (%)	WIND SPEED (MPH)	WIND DIRECTION (DEGREES)
10:00	30.05	78 (26)	79	00	00
10:17	30.05	79 (26)	77	03	300
10:31	30.05	80 (27)	74	03	360
10:46	30.05	80 (27)	74	00	000
11:16	30.05	81 (27)	74	03	240
11:31	30.05	82 (28)	72	05	240
11:43	30.05	82 (28)	72	00	000

*NOTE: SENSORS LOCATED APPROXIMATELY 2 MILES EAST OF MEASUREMENT ARRAY.

APPENDIX J

On-Site Meteorological Data

This appendix presents a summary of meteorological data collected on-site by TSC personnel using a climatronics model EWS weather system. The anemometer and temperature sensor were located 5 feet above ground level at noise site 4. The data collection is further described in Section 5.5.

Within each table, the following data are provided:

Time(EDT)	expressed in Eastern Daylight time
Temperature	expressed in degrees fahrenheit and centigrade
Humidity	expressed as a percent
Windspeed	expressed in knots
Wind Direction	direction from which the wind is blowing
Remarks	observations concerning cloud cover and visibility

TABLE J.1

SURFACE METEOROLOGICAL DATA

TEST DATE: 6-14-83 HELICOPTER: BELL 222 LOCATION: DULLES, SITE #4*

TIME (EDT)	TEMPERATURE °F(°C)	HUMIDITY (%)	WINDSPEED AVG (MPH)	WINDSPEED RANGE (MPH)	WIND DIRECTION (DEGREES)	REMARKS
06:00	64 (18)		no data recorded			
06:15	66 (19)		no data recorded			
06:30	68 (20)	88	no data recorded			Low Fog, 1/4 Mi. Vis.
06:45	69 (21)		no data recorded			Wet Grass, Damp Soil
07:00	71 (22)		no data recorded			
07:15	72 (22)		no data recorded			
07:30	74 (23)		no data recorded			
07:45	74 (23)		no data recorded			
08:00	76 (24)		no data recorded			
08:15	75 (24)		no data recorded			
08:30	79 (26)		no data recorded			
08:45	80 (27)		no data recorded			
09:00	82 (28)		no data recorded			
09:15	84 (29)		no data recorded			
09:30	83 (28)		no data recorded			
09:45	85 (29)		no data recorded			
10:00	86 (30)		no data recorded			
10:15	86 (30)	59	no data recorded			Hazy, Hot, Humid, Sunny
10:30	87 (31)		no data recorded			Dry Grass, Damp Soil
10:45	88 (31)		no data recorded			
11:00	88 (31)		no data recorded			
11:15	90 (32)		no data recorded			
11:30	91 (33)		no data recorded			

*NOTE: SENSOR IS LOCATED 5 FEET ABOVE THE GROUND.

TABLE J.1 (continued)

SURFACE METEOROLOGICAL DATA

TEST DATE: 6-14-83 HELICOPTER: BELL 222 (CONT) LOCATION: DULLES, SITE #4*

TIME (EDT)	TEMPERATURE °F (°C)	HUMIDITY (%)	WINDSPEED AVG (MPH)	WINDSPEED RANGE (MPH)	WIND DIRECTION (DEGREES)	REMARKS
11:45	93 (34)		no data recorded			
12:00	91 (33)		no data recorded			

*NOTE: SENSOR IS LOCATED 5 FEET ABOVE THE GROUND.

TABLE J.2

SURFACE METEOROLOGICAL DATA

TEST DATE: 6-15-83 HELICOPTER: BELL 222 LOCATION: DULLES, SITE #4*

TIME (EDT)	TEMPERATURE °F (°C)	HUMIDITY (%)	WINDSPEED AVG (MPH)	WINDSPEED RANGE (MPH)	WIND DIRECTION (DEGREES)	REMARKS
12:00	84 (29)		no data recorded			
12:15	87 (31)		no data recorded			
12:30	84 (29)		no data recorded			
12:45	86 (30)		no data recorded			
13:00	86 (30)	60	no data recorded			Hazy, High Clouds
13:15	82 (28)		no data recorded			No Sun
13:30	89 (32)		no data recorded			Dry Grass, Moist Soil
13:45	90 (32)		no data recorded			
14:00	95 (35)		no data recorded			

*NOTE: SENSOR LOCATED 5 FEET ABOVE GROUND.

☆U.S. GOVERNMENT PRINTING OFFICE: 1984-421-428/11